

TRANSCRIPT OF PROCEEDINGS BEFORE THE  
STATE OFFICE OF ADMINISTRATIVE HEARINGS  
(TEXAS COMMISSION ON ENVIRONMENTAL QUALITY)  
AUSTIN, TEXAS

APPLICATION OF TEXCOM GULF )  
DISPOSAL, LLC, FOR TEXAS ) SOAH DOCKET NO.  
COMMISSION ON ENVIRONMENTAL ) 582-07-2673  
QUALITY COMMISSION UNDERGROUND ) TCEQ DOCKET NO.  
INJECTION CONTROL PERMIT NOS. ) 2007-0204-WDW  
WDW410, WDW411, WDW412 AND WDW413)

APPLICATION OF TEXCOM GULF )  
DISPOSAL, LLC, FOR TEXAS ) SOAH DOCKET NO.  
COMMISSION ON ENVIRONMENTAL ) 582-07-2674  
QUALITY COMMISSION INDUSTRIAL ) TCEQ DOCKET NO.  
SOLID WASTE PERMIT NO. 87758 ) 2007-0362-IHW

HEARING ON THE MERITS  
MONDAY, DECEMBER 17, 2007

BE IT REMEMBERED THAT at 9:01 a.m., on  
Monday, the 17th day of December 2007, the  
above-entitled matter came on for hearing at the State  
Office of Administrative Hearings, William P.  
Clements, Jr., Building, 300 West 15th Street, Room  
407D, Austin, Texas before THOMAS WALSTON AND  
CATHERINE EGAN, Administrative Law Judges, and the  
following proceedings were reported by Lou Ray, a  
Certified Shorthand Reporter of:

Volume 4

Pages 850 - 1153

<p style="text-align: right;">Page 851</p> <p>1 PROCEEDINGS</p> <p>2 MONDAY, DECEMBER 17, 2007</p> <p>3 (9:01 a.m.)</p> <p>4 (TexCom Exhibit No. 72 marked)</p> <p>5 JUDGE WALSTON: We'll go on the record.</p> <p>6 It's Monday, December 17th, 2007, and this is a</p> <p>7 resumption of the hearing on the merits in SOAH Docket</p> <p>8 Nos. 582-07-2673 and 2674, the Application of TexCom</p> <p>9 Gulf Disposal, L.L.C., for underground injection</p> <p>10 control permits and for an industrial solid waste</p> <p>11 permit.</p> <p>12 Just for the record, the location has</p> <p>13 been changed. We're now holding a hearing at the SOAH</p> <p>14 hearing facilities in Austin, Texas.</p> <p>15 Are there any preliminary matters that</p> <p>16 we need to take up?</p> <p>17 MR. RILEY: No, Your Honor.</p> <p>18 JUDGE WALSTON: Okay.</p> <p>19 MR. WALKER: Your Honor, there is a</p> <p>20 preliminary matter. The applicant has provided us --</p> <p>21 MR. RILEY: I'm sorry, Mr. Walker, I'm</p> <p>22 having trouble hearing you.</p> <p>23 JUDGE WALSTON: Yeah, you can stay</p> <p>24 seated, and you really need to talk in the microphones</p> <p>25 in this room. It's hard to hear.</p>	<p style="text-align: right;">Page 853</p> <p>1 disadvantage.</p> <p>2 MR. RILEY: Well, it was intended to</p> <p>3 place Dr. Collier at a disadvantage, so I'm glad we</p> <p>4 accomplished that goal. What it is, is a review of</p> <p>5 Dr. Collier's work done by Dr. Langhus and the back-up</p> <p>6 material that Dr. Collier cited. So it's nothing more</p> <p>7 than what Dr. Collier has offered to this body in his</p> <p>8 prefiled testimony, looking at the back-up documents</p> <p>9 that he purports support his diagrams and maps and a</p> <p>10 digest of each one of those segments.</p> <p>11 And it will all become clear -- this is</p> <p>12 cross-examination material and it was composed just</p> <p>13 yesterday by Mr. Lee and Dr. Langhus going through</p> <p>14 each one of the purported faults that Dr. Collier has</p> <p>15 placed on a map and put into evidence as Aligned</p> <p>16 Protestant 1P. And the intention is to go through</p> <p>17 with Dr. Collier each one of his lines on that map,</p> <p>18 and that's the nature of cross-examination.</p> <p>19 So I'm not sure how Dr. Collier is</p> <p>20 disadvantaged if indeed he was accurate in putting</p> <p>21 together his exhibit. Then he should have no</p> <p>22 difficulty at all citing to the source material we'll</p> <p>23 ask him about.</p> <p>24 JUDGE WALSTON: Well, why don't we</p> <p>25 proceed, and if it's something that Dr. Collier says,</p>
<p style="text-align: right;">Page 852</p> <p>1 MR. WALKER: The applicant this morning,</p> <p>2 Your Honor, has provided additional disclosures, which</p> <p>3 if I understand correctly, would be information that</p> <p>4 has been reviewed by Dr. Langhus. Is that right,</p> <p>5 Mr. Riley?</p> <p>6 MR. RILEY: No, it's actually</p> <p>7 information that Dr. Langhus compiled yesterday.</p> <p>8 MR. WALKER: This information has been</p> <p>9 provided to us this morning, Your Honor, which</p> <p>10 obviously Dr. Collier, who is about to testify, has</p> <p>11 not had an opportunity to review yet.</p> <p>12 It is a substantial bit of information</p> <p>13 that the applicant is, I presume, intending to</p> <p>14 cross-examine Dr. Collier with this morning based upon</p> <p>15 their expert's review of the information. And, of</p> <p>16 course, it is information, as I understand, that -- I</p> <p>17 suspect the applicant will say was essentially part of</p> <p>18 that information that we disclosed to them the day</p> <p>19 after Dr. Collier's -- or at the time of his</p> <p>20 deposition and then provided copies the day after his</p> <p>21 deposition, which I believe was the 6th of December.</p> <p>22 It places Dr. Collier in a position of</p> <p>23 essentially today having to review and prepare</p> <p>24 information that Dr. Langhus has asserted this</p> <p>25 morning, and I think that places Dr. Collier at a</p>	<p style="text-align: right;">Page 854</p> <p>1 "I need some time to review this," then we may take a</p> <p>2 break and let him review it. But we'll proceed and</p> <p>3 see how it goes.</p> <p>4 MR. WALKER: I will point out that on</p> <p>5 the face of the disclosure, Your Honor, there is a</p> <p>6 reference that Dr. Langhus has reviewed or prepared</p> <p>7 the attached documents in anticipation of his</p> <p>8 testimony. That's an erroneous assertion. This</p> <p>9 information was not prepared by Dr. Langhus in</p> <p>10 anticipation of his testimony. He's already</p> <p>11 testified.</p> <p>12 MR. RILEY: It's in anticipation of his</p> <p>13 rebuttal testimony. If that's a clarification you</p> <p>14 need, Mr. Walker, then we can certainly make it here</p> <p>15 on the record.</p> <p>16 MR. WALKER: All right. Thank you, Your</p> <p>17 Honor.</p> <p>18 JUDGE WALSTON: Anything else on a</p> <p>19 preliminary matter?</p> <p>20 MR. WALKER: Nothing else.</p> <p>21 JUDGE WALSTON: Okay. If Dr. Collier</p> <p>22 will step up to the witness stand?</p> <p>23 Will you raise your right hand?</p> <p>24 (Witness sworn)</p> <p>25 JUDGE WALSTON: Be seated, and state</p>

<p style="text-align: right;">Page 855</p> <p>1 your full name for the record.</p> <p>2 WITNESS COLLIER: Hughbert Arnold</p> <p>3 Collier.</p> <p>4 JUDGE WALSTON: Dr. Collier, you're</p> <p>5 doing a good job. Keep it up trying to talk directly</p> <p>6 into the microphone if you can there. They're not</p> <p>7 very good unless you're almost right on top of it.</p> <p>8 WITNESS COLLIER: All right.</p> <p>9 MR. WALKER: May I proceed, Your Honor?</p> <p>10 JUDGE WALSTON: Yes.</p> <p>11 PRESENTATION ON BEHALF OF</p> <p>12 THE ALIGNED PROTESTANTS</p> <p>13 HUGHBERT A. COLLIER,</p> <p>14 having been duly sworn, testified as follows:</p> <p>15 DIRECT EXAMINATION</p> <p>16 BY MR. WALKER:</p> <p>17 Q Dr. Collier, have you been retained in this</p> <p>18 contested hearing to provide expert testimony?</p> <p>19 A Yes, I have.</p> <p>20 Q And are you a doctor of philosophy in the</p> <p>21 discipline of hydrogeology?</p> <p>22 A Yes.</p> <p>23 Q Have you given pre-filed testimony in this</p> <p>24 cause?</p> <p>25 A Yes.</p>	<p style="text-align: right;">Page 857</p> <p>1 MR. RILEY: I guess the answer to</p> <p>2 question would be "no," if it's not complete?</p> <p>3 WITNESS COLLIER: Well, no, my answer</p> <p>4 stays the same because all throughout this Geomap maps</p> <p>5 are public record. You know, they're available to the</p> <p>6 public, if you purchase them.</p> <p>7 MR. RILEY: So then you don't need to</p> <p>8 change that answer?</p> <p>9 WITNESS COLLIER: I guess not.</p> <p>10 MR. RILEY: Okay.</p> <p>11 Q (By Mr. Walker) Anything else on Page 28,</p> <p>12 Dr. Collier?</p> <p>13 A That's everything on Page 28.</p> <p>14 Q Was there a correction on Page 5?</p> <p>15 A On Page 28, Line 16 --</p> <p>16 Q I'm sorry.</p> <p>17 A -- "compilation of faults identified in</p> <p>18 public records and by Geomap Company."</p> <p>19 Q Okay. Is there a correction on Page 5?</p> <p>20 A Yes. Page 5, Line 9 and 10, it should read,</p> <p>21 "I have given depositions eight times or more and one</p> <p>22 of these at the Railroad Commission."</p> <p>23 JUDGE WALSTON: Say that again now.</p> <p>24 WITNESS COLLIER: The phrase "at the</p> <p>25 Texas Railroad Commission" should be after "I have</p>
<p style="text-align: right;">Page 856</p> <p>1 Q At this time, Dr. Collier, do you have any</p> <p>2 corrections to your prefiled testimony?</p> <p>3 A Yes.</p> <p>4 Q On Page 28, Line 3 --</p> <p>5 MR. RILEY: Could we have a minute while</p> <p>6 we get to that page?</p> <p>7 I'm there. Thank you.</p> <p>8 JUDGE WALSTON: Okay.</p> <p>9 A It should state "compilation of faults</p> <p>10 identified in public records and Geomap structure maps</p> <p>11 and drafted by."</p> <p>12 Q Anything else on that page, Dr. Collier?</p> <p>13 A Line 11 should state "through 1-M and the</p> <p>14 maps from Geomap Company."</p> <p>15 Q All right. Anything else on that page?</p> <p>16 A Line 12 should state, "Is this document a</p> <p>17 true and correct compilation of the public records and</p> <p>18 Geomap Company information?"</p> <p>19 Q All right.</p> <p>20 A Line 16 --</p> <p>21 MR. RILEY: I'm sorry, the witness is</p> <p>22 correcting a question. Is that -- instead of</p> <p>23 correcting an answer, he was correcting a question he</p> <p>24 was asked.</p> <p>25 JUDGE WALSTON: I guess so.</p>	<p style="text-align: right;">Page 858</p> <p>1 given depositions eight times or more, one of these at</p> <p>2 the Railroad Commission."</p> <p>3 Q (By Mr. Walker) Dr. Collier, any other</p> <p>4 corrections to your testimony?</p> <p>5 A On Exhibit 1P in the legend -- I believe it's</p> <p>6 the last item identified in the legend.</p> <p>7 JUDGE EGAN: Is it 1P or 1T?</p> <p>8 WITNESS COLLIER: "P" as in Paul.</p> <p>9 JUDGE EGAN: Okay. Thank you.</p> <p>10 A I think it presently states, "The completion</p> <p>11 data and water map from January 1st, 1944," and the</p> <p>12 source is from the Texas Railroad Commission files.</p> <p>13 So that's in the legend, the bottom line of the</p> <p>14 legend, just add to the last line "from the Texas</p> <p>15 Railroad Commission files."</p> <p>16 Q (By Mr. Walker) Dr. Collier, any other</p> <p>17 corrections to your testimony?</p> <p>18 A None.</p> <p>19 Q With those corrections, Dr. Collier, do you</p> <p>20 adopt your prefiled testimony and the accompanying</p> <p>21 exhibits as if you were testifying in person?</p> <p>22 A I do.</p> <p>23 MR. WALKER: At this time, Your Honor,</p> <p>24 the Aligned Protestants would offer into evidence the</p> <p>25 prefiled testimony of Dr. Hughbert Collier as Exhibit</p>

1 1, additionally Exhibits 1A, through 1Q; and then  
 2 additionally Exhibits 1R through 1V, as in Victor.  
 3 And those exhibits, 1R through 1V, are the exhibits  
 4 sealed under the protective order. Let the record  
 5 please reflect that these exhibits are being tendered  
 6 to the court reporter, two copies of each, as well as  
 7 the testimony.

8 MR. RILEY: And while that's being done,  
 9 I just have a procedural question, I suppose. When I  
 10 cross-examine on the matters that are subject to the  
 11 protective order and under seal in the record, how  
 12 would like me to handle that? Would you like me to --  
 13 I don't know that the protective order requires us to  
 14 do anything regarding the folks in attendance, and  
 15 they're -- I guess they're not under -- they're not  
 16 necessarily subject to the protective order, so I'm  
 17 asking for clarification on how you would like me to  
 18 handle that, Judges?

19 JUDGE WALSTON: When you get to a point  
 20 we're going to go into a matter that's contained in  
 21 the exhibits that are sealed -- you'll have to refresh  
 22 my memory what the protective order states. I assume  
 23 we would need to exclude people who are not covered by  
 24 the protective order from the room.

25 MR. RILEY: That's typically what's

1 done. I don't know if that's necessary in this case  
 2 since the information is provided by the Aligned  
 3 Protestants, Montgomery County and City of Conroe. I  
 4 don't know if that's something they would require.  
 5 Typically, when it's business confidential information  
 6 in these hearings, it is necessary to actually clear  
 7 the room of folks who are not subject to the  
 8 protective order. So I will leave it to those -- to  
 9 the Intervenors to explain how they would like to  
 10 handle it.

11 MR. WALKER: In response to that, Your  
 12 Honor, the protective order states that the release of  
 13 the materials is prohibited to anyone who is not a  
 14 party to the litigation or representative of a party,  
 15 a consultant or expert witness working with or  
 16 retained by a party, or a TCEQ Commissioner, judge, or  
 17 other individual who may be called upon to evaluate  
 18 TexCom's applications that are subject to these  
 19 proceedings.

20 So I suppose, if I can summarize that,  
 21 parties, experts, TCEQ representatives, a  
 22 representative of a party, those would be admissible  
 23 individuals to hear the -- or to be present. Anyone  
 24 else would apparently need to be excused.

25 JUDGE WALSTON: When we get to that,

1 bring it up and we'll see if there is someone who is  
 2 not covered by the protective order in attendance and  
 3 we'll excuse those persons.

4 MS. GOSS: Your Honor?

5 JUDGE WALSTON: Yes.

6 MS. GOSS: The ED needs some  
 7 clarification on these exhibits. We have a Bates  
 8 numbers AP-220, 223, 224 and 227, and could you let us  
 9 know which ones of those are 1R, et cetera?

10 MR. WALKER: I'm confused by that  
 11 numbering. I'm not certain --

12 JUDGE WALSTON: Are those part of the  
 13 confidential exhibits?

14 MS. GOSS: Yes, he just -- pardon me.

15 Mr. Walker just got 1R through 1V admitted, and I'm  
 16 trying to determine which are which.

17 JUDGE WALSTON: Okay.

18 MR. WALKER: R, S and T, for the record,  
 19 are the P2 Solutions; Exhibits U and V are the Geomap  
 20 exhibits.

21 JUDGE EGAN: R, S and T are what?

22 MR. WALKER: R, S and T are the exhibits  
 23 from P2 Solutions --

24 JUDGE EGAN: Okay.

25 MR. WALKER: -- U and V are from Geomap

1 Company.

2 JUDGE EGAN: Okay.

3 JUDGE WALSTON: And refresh my memory,  
 4 were there any objections to the testimony of  
 5 Dr. Collier that were made or sustained?

6 MR. WALKER: None that were sustained,  
 7 Your Honor.

8 JUDGE WALSTON: I didn't think there  
 9 were.

10 Okay. Then objections have previously  
 11 been ruled upon and Aligned Protestants Exhibits 1, 1A  
 12 through 1Q and 1R through 1V are admitted. And we'll  
 13 just note for the record that 1R through V are sealed.

14 (AP Exhibit Nos. 1 and 1A through 1V  
 15 admitted)

16 MR. WALKER: Thank you, Your Honor.

17 With that, the Aligned Protestants will pass the  
 18 witness for cross-examination.

19 JUDGE WALSTON: Okay. Lone Star?

20 MR. HILL: No questions.

21 JUDGE WALSTON: Individual Protestants?

22 MR. FORSBERG: No questions, Your Honor.

23 JUDGE WALSTON: Public Interest Counsel?

24 MS. COLLINS: No questions.

25 JUDGE WALSTON: Okay. Applicant?

MR. RILEY: I do have some questions,  
yes.

CROSS-EXAMINATION

BY MR. RILEY:

Q Good morning, Dr. Collier.

A Good morning.

Q Are you able to hear me from where you're seated?

A Yes.

Q All right. I'll try to keep my voice up. I'm having a little trouble with my voice this morning, but I will try to speak into the microphone so that we can proceed with this examination. If you have any trouble hearing me, please let me know and I'll try to speak up even louder.

Firstly, Dr. Collier, I want to be certain that I understood our discussion during your deposition about your prior experience with injection wells and injection disposal wells. And it's my understanding that you have looked at only one -- prior to the review of the TexCom permit application, you had only reviewed one Class II Railroad Commission application in any depth. Is that correct?

A Correct.

Q So you're -- the sum total of your experience

in disposal well review or review of applications for disposal wells, either at the Railroad Commission or the TCEQ is one application that you reviewed for a matter before the Railroad Commission?

A Correct.

Q And again, that was a Class II well. Is that correct?

A Correct.

Q Is it fair to conclude then that you have never reviewed an application to the TCEQ for a Class I disposal well?

A Correct.

Q What portions of the TexCom application did you review as part of your engagement by Montgomery County and the City of Conroe and in preparation for your testimony here this morning?

A My testimony -- my review and examination concentrated on Section 5, Section 7 and Section 8.

Q Did you review any other portions of the application?

A I read through some of it.

Q Can you be more specific, sir?

A I read through the application, but my review -- the work that I did was in Sections 5, 7 and 8.

Q Okay. Did you read through the entire application and all the exchanges with the TCEQ, the correspondence typically referred to as the notice of deficiency response?

A Yes.

Q If I understand your testimony correctly, you are not qualified to give opinions or to conduct reservoir modeling. Is that correct?

A Correct.

Q Is it fair to say, Doctor, that your testimony concentrated -- excuse me, your preparation and your testimony concentrated on identifying additional artificial penetrations in the area of review around the proposed TexCom facility, and additional faults in the area of review as you saw them?

A That was a major part of what I looked at.

Q Tell me all the parts of your review and what you did.

A In addition to those two parts, I reviewed all of the Section 5, which includes the local and regional hydrogeology and geology; looked at the parts of the application that require the applicant to inventory all wells, including water wells, within the area of review and then within a one-mile radius of

the property. I looked at the parameters that were used in the reservoir modeling.

Q What parameters did you look at regarding the reservoir modeling?

A I looked at the porosity, the permeability, the -- the aerial extent that the model is based on.

Q I'm sorry, I didn't understand the last portion of your answer. You looked at the aerial extent --

A The aerial extent.

Q Of what?

A That the model is based on. The model is based on some aerial extent geographic area.

Q Have you ever run a reservoir model?

A No.

Q Okay. And how did you review the reservoir modeling without having prior knowledge of reservoir modeling or being able to conduct reservoir modeling?

A Well, the applicant is required to list in the application all that -- the parameters that are input into the model. Those parameters are geological parameters that are based upon the study that was done or not done in Section 5, which is the geology. So you have to do the geology first in order to have the proper parameters to run in the model.

1 Q And what parameters, if any, do you have  
 2 difficulty with or do you disagree with that were  
 3 input into the reservoir modeling?  
 4 A The aerial extent for the model not having  
 5 any -- aerial extent for no boundaries, and then the  
 6 permeability from the Fall-off test is different from  
 7 the permeability that was the core analysis that was  
 8 used in the model.  
 9 Q All right. Let's talk about the last part of  
 10 your answer. First you have a disagreement with the  
 11 permeability that was used in the TexCom modeling. Am  
 12 I understanding you correctly?  
 13 A Correct.  
 14 Q And why is that, sir?  
 15 A Well, they used 500 millidarcies in the  
 16 model, and the Fall-off test gives a calculation of --  
 17 I think it was 81 -- 80-something millidarcies.  
 18 Q Have you ever conducted a Fall-off test, sir?  
 19 A No.  
 20 Q Do you know what it involves?  
 21 A Yeah, I know what it involves.  
 22 Q What does it involve?  
 23 A It involves injecting at some rate -- I think  
 24 they injected at, I believe, it was three  
 25 barrels-per-minute, and injecting -- pressuring up an

1 interval for a time and then measuring the pressure as  
 2 it declines over a period of time after you conclude  
 3 injecting.  
 4 Q Have you ever interpreted or reviewed  
 5 Fall-off data tests or data from a Fall-off test prior  
 6 to this case?  
 7 A No.  
 8 Q Were you able to review the test data for the  
 9 Fall-off test that you're referring to?  
 10 A I did not.  
 11 Q Where did you -- how did you then identify a  
 12 difference in permeability as between the model inputs  
 13 and what you believe was the Fall-off test result?  
 14 A It's mentioned in the records.  
 15 Q In the application, is it not, sir?  
 16 A Yes.  
 17 Q Do you understand the zone that was  
 18 perforated in the original well WDW-315 and how many  
 19 feet of perforation were done in that test?  
 20 A Yes.  
 21 Q And what was the -- what was the number of  
 22 feet in WW -- WDW-315 for the Fall-off test?  
 23 A It was a little over 100 feet.  
 24 Q Does 90 sound correct, sir?  
 25 A It may -- it may be.

1 Q Other than regurgitating what's in the  
 2 application already regarding the Fall-off test, do  
 3 you have any ability to interpret Fall-off test data?  
 4 A No.  
 5 Q And you mentioned a core analysis that's also  
 6 in the permit application. Do you know what a core  
 7 analysis is?  
 8 A Yes.  
 9 Q What is it, sir?  
 10 A It's a sample of the formation that is  
 11 removed during the drilling process, submitted to a  
 12 lab, and then various petrophysical parameters are  
 13 measured on it.  
 14 Q Would one of those petrophysical parameters  
 15 measured include permeability?  
 16 A Yes.  
 17 Q Were the core samples from the WDW-315  
 18 evaluated in a laboratory?  
 19 A Yes.  
 20 Q And what were the results of those tests  
 21 regarding permeability?  
 22 A I believe the permeability was listed as  
 23 approximately 500 millidarcies.  
 24 Q Is it actually true, sir, that it's listed in  
 25 a range?

1 A It may well be.  
 2 Q Okay. Do you know what the range is, sir?  
 3 A No.  
 4 Q How much time did you spend reviewing the  
 5 core sampling data in the TexCom application?  
 6 A Not a lot of time.  
 7 Q Do you know where the core sample was taken  
 8 in terms of the wellbore and the perforated interval  
 9 that is -- was evaluated in the Fall-off test?  
 10 A I don't know the exact depth.  
 11 Q Do you know where it is in relationship to  
 12 the perforated interval that was tested in the  
 13 Fall-off test?  
 14 A Not without going back and looking to see the  
 15 exact depth.  
 16 Q And yet you disagree with the use of that --  
 17 let's assume you're correct that it's approximately  
 18 500 millidarcies -- you disagree with using that  
 19 permeability in reservoir modeling. Is that correct?  
 20 A Well, that value can be used, but when you  
 21 have additional data such as a Fall-off test, it's  
 22 what's called a matter of scale. And you have to look  
 23 and decide -- if you have a discrepancy -- which of  
 24 the two are more representative. And you see in the  
 25 application they obviously believe that the zone that

1 they had perforated is too tight for production  
2 because the application states that they're going to  
3 abandon that zone and move up the wellbore and  
4 perforate an upper interval.

5 Q What did you mean when you said "too tight  
6 for production"? I don't understand that term.

7 A Well, too tight for injection.

8 Q Well, the -- do you understand that the  
9 TexCom application proposes to perforate different  
10 intervals within the injection zone?

11 A Yes.

12 Q All right. So tell me your understanding of  
13 the relevance of the Fall-off test given that  
14 knowledge, that TexCom believes that there are more  
15 permeable sands available in the well than were  
16 originally perforated?

17 A Well, the reservoir modeling that had been  
18 done to present has to be based upon data that's  
19 available.

20 Q And what are you basing that statement on,  
21 sir?

22 A If you're going to -- the reservoir modeling  
23 includes porosity, permeability. Since you have a  
24 Fall-off test, that's the data that you have at the  
25 time to input into the model.

1 Q Well, what statement -- you've never handled  
2 a Class II Well application, correct?

3 A Correct.

4 Q And you've never performed reservoir  
5 modeling, you've never reviewed Fall-off test data,  
6 and yet you're stating under oath on the record that  
7 you must use that Fall-off test data in this  
8 application. Is that your testimony?

9 A Yes, because what I have done is a lot of  
10 core analysis and integration of core analysis with a  
11 wireline log, with pumping tests, with reservoir  
12 characterization. And it's the same principles for  
13 that work that it is in this case.

14 Q What is "that work" that you -- you so  
15 vaguely refer to "that work," what work are you  
16 referring to?

17 A Any type of work in which you have core  
18 analysis, in which you have wireline logs, in which  
19 you have aquifer tests and you integrate the data to  
20 characterize the reservoir. And I've done those type  
21 of projects in Florida and in Texas in various  
22 aquifers -- reservoirs in Texas and other states as  
23 well. So the principles are all the same whether it's  
24 a Class I injection well, a Class II injection well,  
25 or whether it's just what we call reservoir or aquifer

1 characterization.

2 Q Well, I understand that's your -- I guess  
3 your statement of qualification to make such a  
4 statement of what is required in this case, but I'm  
5 trying to understand since you've never -- other than  
6 the one occasion you've already testified about  
7 regarding a Class II well at the Railroad  
8 Commission -- you've never done this work for  
9 injection wells. Is that correct?

10 A Correct.

11 Q Do you understand the regulatory process  
12 following permitting of an injection well?

13 A Somewhat.

14 Q All right. Do you understand that if indeed  
15 the Fall-off test originally done is correct and the  
16 permeability of the new interval perforated by TexCom  
17 is 81 millidarcies, that additional considerations are  
18 required before waste could ever be injected?

19 A Correct.

20 Q So if indeed you are correct -- although  
21 obviously the application believes otherwise, or  
22 applicant believes otherwise -- that the permeability  
23 is 81 millidarcies, then the TCEQ would require the  
24 applicant to make additional considerations before any  
25 waste could be injected. Do you understand that?

1 A Correct.

2 Q What is your opinion as to the permeability  
3 of the lower Cockfield sands?

4 A It is low permeability.

5 Q You're going to have to be more specific,  
6 sir. What in millidarcies or darcies is the  
7 permeability of the lower Cockfield sand?

8 A Well, you can't put an exact number on it.  
9 You look at the logs. You see that the sands are  
10 thin -- relatively thin. There's a lot of shale  
11 interbedded with them. So, you know, is it 80  
12 millidarcies? If it's going to have some variation  
13 without some type of analysis such as additional core  
14 analysis, or additional type of pressure testing, you  
15 can't put an exact number on it. But the applicant in  
16 the application --

17 Q That's not my question, sir. I asked you --  
18 and I object to you giving an answer other than what  
19 I'm asking you, and I'd ask that the Judges instruct  
20 you to confine your answer to the question.

21 A Well, I am confining my answer to the  
22 question --

23 Q I asked you if you had an opinion as to the  
24 permeability of the lower Cockfield?

25 A Yes. And the applicant in the application

1 talks about the low permeability of the sand. There  
2 are no numbers that are given, but due to the  
3 depositional nature of the sand, it's recognized and  
4 you can see that -- I see that in the data -- that the  
5 permeabilities are low. Exactly how low, I can't -- I  
6 can't give you an exact number. But obviously the  
7 applicant thinks they're low enough that they're not  
8 going to inject into those sands.

9 Q Well, do you understand what -- what interval  
10 the application or the applicant proposes to inject  
11 into?

12 A Yes.

13 Q And what is that?

14 A They were -- they want to move up and  
15 re-perforate about -- I think it's some 6,040 roughly  
16 to about 6180.

17 Q Does that correlate with a geologic stratum?

18 A Yes.

19 Q What is it?

20 A That's still fairly low in the Cockfield.  
21 And the applicant in their application talk about  
22 that --

23 Q I asked you does it correlate to a geologic  
24 stratum in your opinion?

25 A The 60 -- 6040 to 6180 is the lower part of

1 Q Correct me if I'm wrong, Dr. Collier, the  
2 upper Cockfield runs from a depth of 5134 to 5629. Is  
3 that correct or incorrect?

4 A That's correct.

5 Q And the middle Cockfield runs from a depth of  
6 5629 to 6045. Is that correct or incorrect?

7 A Well, on the exhibit that I'm looking at,  
8 they're identifying the top of the lower Cockfield as  
9 6291. There may have been a later revision of this.

10 Q I don't know what you're looking at, sir.

11 A This is the applicant's figure V.b.1.3, dated  
12 8-1-05.

13 Q And what is your testimony then regarding the  
14 thickness and the depth of the middle Cockfield?

15 A Well, I'm going off what the applicant --

16 Q Do you have a separate opinion other than  
17 what's in the application, Dr. Collier?

18 A No, not as to the top of the lower Cockfield.

19 Q So you're reading from the applicant's --  
20 your interpretation of the application. Is that  
21 correct?

22 A No, it's not my interpretation from the  
23 application.

24 Q Okay. You've referenced one exhibit in the  
25 application. Do you know what it is you're

1 the middle Cockfield.

2 Q Is that your understanding?

3 A That's from the applicant's Page 73, figure  
4 Roman Numeral V.b.1.3 --

5 Q And so --

6 A It's -- yeah, that's right.

7 Q So your understanding of the proposed  
8 injection interval in the application is the lower  
9 part of the middle Cockfield?

10 A They originally were putting it in the lower  
11 Cockfield, and then they mention that they're going to  
12 have to go ahead and move up higher, which would be  
13 the lower part of the middle Cockfield. The original  
14 interval is the lower Cockfield.

15 Q Do you not understand, sir, that they're  
16 moving up within the lower Cockfield higher than the  
17 original perforated zone, but not above the shale  
18 later between the lower and the middle Cockfield? Do  
19 you not understand that?

20 A That's not what I read in the application.

21 Q Do you not understand that, sir?

22 A Apparently I don't.

23 Q How thick is the lower Cockfield, sir?

24 A The lower Cockfield is identified by the  
25 applicant as being 100 -- about 110 feet thick.

1 referencing?

2 A I've told you what it is twice.

3 Q You've told me the letter. Do you know what  
4 it is?

5 A It is the Cockfield formation in WDW-315 well  
6 illustrated with open hole wireline logs.

7 Q Are there other boring logs in the  
8 application?

9 A Yes, they have copies of their logs.

10 Q And do you have -- have you reviewed those  
11 other logs?

12 A I don't have them here before me.

13 Q That's not my question, sir. You said you  
14 reviewed the application. My question is did you  
15 review those borrowing logs before your testimony here  
16 this morning?

17 A I have looked at those logs.

18 Q Have you reviewed them sufficiently to offer  
19 an opinion as to the depth of the various stratum  
20 thereof concerned in this proceeding?

21 A I accept the applicant's designations.

22 Q So if the applicant designated the middle  
23 Cockfield of a depth of 5629 to 6045, you have no  
24 basis to disagree with that designation?

25 A I have no problem with that.



<p style="text-align: right;">Page 879</p> <p>1 Q And you have no problem, I assume then, with  2 the application's designation of the lower Cockfield  3 as 6045 to 6390?  4 A No.  5 Q Can you tell me the -- starting from the  6 surface -- the various stratum that underlie the  7 proposed TexCom site?  8 A Yes.  9 Q If you're referring to something, please let  10 us know what you're referring to.  11 A I'll refer to the -- the applicant has a  12 strat column on Page V-18, and I accept their  13 stratigraphic column. They call it a hydrologic strat  14 column for the TexCom WDW-315 well.  15 Q Could you read, starting from the surface,  16 the various stratum that underlie the TexCom site?  17 JUDGE WALSTON: Let me ask you: Is this  18 one of the exhibits attached to your testimony as  19 well?  20 WITNESS COLLIER: No.  21 JUDGE WALSTON: No.  22 WITNESS COLLIER: This is in the  23 application. This is Figure V.b.2.1.  24 MR. RILEY: Would it be helpful if we  25 identified that figure in the applications and then</p>	<p style="text-align: right;">Page 881</p> <p>1 Section 5 --  2 WITNESS COLLIER: Yes.  3 JUDGE EGAN: -- Page 78 of 315 --  4 MR. RILEY: That's what we have as ours  5 also.  6 WITNESS COLLIER: Yes, that's right.  7 JUDGE EGAN: I believe it's exhibit --  8 MR. RILEY: That's correct.  9 Q (By Mr. Riley) Doctor, this particular  10 hydrologic strat column does not go all the way down  11 to the Cockfield shale. Is that correct?  12 A Correct.  13 Q Are you able to tell me the stratum that  14 underlie the TexCom site all the way down to the  15 Cockfield shale?  16 A Yes. You start on Page 78. I accept their  17 designations on Page 78. And then if you back up a  18 couple of pages, on Page 74 they show then the Jackson  19 formation underlying the Catahoula down to 5180, and  20 then the Cockfield formation from 5180 on down to the  21 lower confining zone of the Cockfield.  22 Q All right. And you have no reason to  23 disagree with those characterizations in the  24 application or the identification of the stratum in  25 the application?</p>
<p style="text-align: right;">Page 880</p> <p>1 point you to a page?  2 JUDGE EGAN: Thank you.  3 MR. RILEY: Thank you.  4 WITNESS COLLIER: In the original  5 application of 8-1-05 this is Page 78 of 314.  6 MR. WILLIAMS: Do you know what volume?  7 MS. GOSS: Do you have volume numbers?  8 WITNESS COLLIER: I'm working on it.  9 This is Volume 1.  10 MR. RILEY: The volume number -- at  11 least I believe what the witness may be looking at --  12 is Volume 2 --  13 WITNESS COLLIER: Your application has  14 Volume 1.  15 MR. RILEY: So these are exhibits, but  16 if you have a copy of the exhibit and you can focus us  17 more narrowly, I'd appreciate that. Is it a volume  18 that is an exhibit in the case or is it a volume --  19 WITNESS COLLIER: It's your application.  20 JUDGE EGAN: It appears to be Volume 2  21 in our volumes. They've been marked differently from  22 the exhibits.  23 WITNESS COLLIER: Mine is marked as  24 Volume 1.  25 JUDGE EGAN: And it is Section -- under</p>	<p style="text-align: right;">Page 882</p> <p>1 A No.  2 Q I'd like to show you what has been previously  3 marked as TexCom Exhibit 72, and perhaps that will be  4 easier to work with for this series of question.  5 Dr. Collier, could you take a minute and  6 review Exhibit 72 and compare it to the pages that you  7 just pointed us to in the application and make sure  8 that the stratum are listed in the correct order and  9 properly under the -- as they are on this exhibit,  10 Exhibit 72?  11 A (No response)  12 Q Again, all I'm asking for, Doctor, is in  13 relative location, not anything beyond -- I'm not  14 asking you to agree with or verify anything other than  15 the order of stratum below the site?  16 A I agree.  17 Q Okay. And have you had sufficient time to  18 review it and compare it to the application that you  19 just adopted?  20 A Yes.  21 Q So am I correct in saying that at least as it  22 pertains to the order of the stratum below the  23 proposed TexCom site, Exhibit 72 is accurate?  24 A Correct.  25 MR. RILEY: At this time I offer into</p>

1 the record TexCom Exhibit 72.

2 JUDGE WALSTON: Any objection?

3 Hearing none, TexCom Exhibit 72 is  
4 admitted.

5 (TexCom Exhibit No. 72 admitted)

6 Q (By Mr. Riley) Doctor, I think this will be  
7 easier to work with than the application in the  
8 binder, so let's look at Exhibit 72 together. And the  
9 question I have of you is would -- what is a horizon?  
10 When one is talking in geologic terms and is looking  
11 at a horizon, what would one be describing?

12 A Well, I think most people would be talking  
13 about a formation. It would be an identifiable unit  
14 in the subsurface that has unique enough  
15 characteristics to be separated from the strata above  
16 it and below it.

17 Q All right. And is it fair to say then, at  
18 least in what seems to be accepted geologic terms,  
19 that each of these various stratum are -- fit that  
20 qualification, they are different horizons?

21 A That would be -- that's more a layman's term.  
22 That would be fine.

23 Q Now, when one talks about mapping a horizon,  
24 what is one discussing in your understanding?

25 A Well, mapping a horizon, you're -- you're

1 mapping identifiable characteristic. Usually it is  
2 based upon wireline logs. So it could be a  
3 radioactive marker. It could be some other  
4 distinguishing characteristic, and you're preparing a  
5 subsurface map based upon that identifying  
6 characteristic.

7 Q And is that a -- well, let me ask you a  
8 different question: Are most wells when they're  
9 drilled cored and evaluated by a geologist?

10 A No.

11 Q Why is that?

12 A In the old days, they did. Nowadays  
13 relatively few wells are cored, mainly because of  
14 expense.

15 Q Am I correct then in understanding wirelines  
16 and other types of marker evaluations are not done by  
17 evaluating -- by evaluating a core sample?

18 A If they're available, they would be  
19 integrated with it. But since they're usually not  
20 available, then wireline logs are -- the correlations  
21 are made without cores, correct.

22 Q Okay. So a wireline -- what is a wireline?  
23 Can you be more descriptive?

24 A It's called wireline logs or you could just  
25 call it logging. It's -- they are different tools

1 that are lowered into a borehole on a wireline to  
2 either measure naturally-occurring physical properties  
3 of the subsurface, or to induce various either  
4 electrical current or radioactive elements to measure  
5 the physical properties.

6 Q Am I correct then what a wireline is doing --  
7 or someone who is engaged in using a wireline tool --  
8 is trying to evaluate the stratum in a wellbore?

9 A Correct.

10 Q As between wireline data and actual core  
11 samples, which would you consider more reliable for  
12 depicting the stratum in a particular wellbore?

13 A Well, the absolute ground truth is core.

14 Q I understand your answer to be that a core  
15 sample would be more reliable than a wireline  
16 evaluation?

17 A For -- yes, for that particular interval that  
18 the core is taken, yes.

19 Q So for that well. I'm not talking more  
20 generally than that. For that well, if you're doing a  
21 wireline versus evaluating a core, as a geologist I  
22 assume you'd rather have the core data itself?

23 A Well, your question mixes up -- if you  
24 continuously cored the well or whatever interval  
25 you're in -- let's say in this case your injection --

1 if you continuously cored it, that is the absolute  
2 best data. If you only have one or two selected cores  
3 out of it, then your best data, as far as  
4 characterizing the well, as you've said, or the  
5 interval, that best data is going to be the wireline  
6 log.

7 Q Okay. And I didn't mean to be misleading.  
8 I'm assuming in a hypothetical sense that when I've  
9 drilled a well, I've cored from the surface all the  
10 way down to the bottom or the total depth of the well  
11 and I have that core available. As between a core  
12 such as the one I just described and a wireline, am I  
13 correct that the core data is more reliable?

14 A Yes.

15 Q What other types of data or tools are used to  
16 evaluate the geologic stratum in a wellbore?

17 A Well, sometimes you look at the cuttings of  
18 the well -- from the well --

19 Q If you could explain what a cutting is so we  
20 all understand?

21 A Well, as you're drilling the well, what  
22 you're drilling through has to be removed from the  
23 well. And those samples, which are called cuttings,  
24 are brought up to the surface and you can study them.  
25 You can look at various types of pressure testing,

1 drill stem-test, any type of pressure testing of your  
2 formation will give you some information about your  
3 zone that you're studying.

4 Q Now, in trying to get a picture of what the  
5 stratum are as one drills through them, we've already  
6 discussed coring and wire logs, using -- excuse me, a  
7 wireline -- using a wireline, am I looking for  
8 something as a marker in the wellbore that gives me  
9 a -- I guess a point of depth? Do you understand my  
10 question?

11 A Well, you're looking at that plus a lot of  
12 other things. You're measuring physical properties of  
13 the rock as you raise that tool from the bottom up to  
14 the top. It's a continuous measurement of these  
15 various physical properties.

16 Q And what I'm trying to understand, Doctor --  
17 let's -- you used the term radioactive marker, and  
18 what is a radioactive marker?

19 A Well, it's a -- it's a zone that has a high  
20 enough radioactive signature, and if it is consistent  
21 across an area, then it can be used as a marker and  
22 you can map based on it.

23 Q Let me see if I understand. If I took a  
24 hypothetical field and I did a number of different  
25 well borings and I found at a certain depth -- or

1 approximately the same depth -- a radioactive marker  
2 of the type you described. What I -- and I correlated  
3 those between and among the wells that I have drilled,  
4 then I'd be at least postulating that that's a point  
5 in geologic history that is common to those wells. Am  
6 I following along?

7 A Yes.

8 Q So I would map that in the sense of I -- if  
9 it appeared deeper in one well than another well, I  
10 could at least make some assumptions as to what the  
11 stratum was like as between those wells. Am I making  
12 sense?

13 A Correct.

14 Q All right. And just for clarification, let's  
15 say I find a radioactive marker in one well at  
16 100 feet deep, just to make it simple, and in another  
17 well I find that radioactive marker that I believe are  
18 the same geologic event or correlates to the same  
19 geologic event that deposited the radioactive  
20 material, and I find that at 200 feet, what does that  
21 tell me, if anything, as between those two wells?

22 A If it is the same radioactive marker, it  
23 means that there has been movement in the -- it means  
24 that there is very probably been fault between those  
25 two wells.

1 Q Could it mean that the surface was uneven at  
2 the time the radioactive marker was deposited?

3 A You could have that.

4 Q So if I had a hill -- let's say in geologic  
5 time I had a hill that was a 25-foot hill -- or  
6 variation; let's not call it a hill -- a variation in  
7 a surface stratum or at the surface, and then whatever  
8 event occurs that deposits a radiologic marker, and  
9 then a couple million or whatever number, tens of  
10 millions of years pass, could that hill or high point  
11 on the surface show up as a different depth, then in  
12 the hypothetical I was trying to construct -- say  
13 there was a 25-foot difference between where I found  
14 the radiological marker in one well and radiological  
15 marker in another well, could that just be a variation  
16 in surface topography at the time of deposition?

17 A Could be.

18 Q Without any further information, how would  
19 you distinguish that variation in the radioactive  
20 surface marker as between a variation at the time of  
21 deposition or a variation because of movement or  
22 faulting?

23 A You could look at the lithology above and  
24 below your radioactive marker. And if you've got a  
25 difference like that -- say a hill -- then chances are

1 your fill material in your lower area might well be  
2 different than the other one. So you would look at  
3 the -- you would look at the log above and below your  
4 radioactive marker to get an indication of that.

5 Q Okay. But is there a definitive way to  
6 determine whether it was an undulation in the surface  
7 at the time of deposition or it was a fault that  
8 occurred at some subsequent time?

9 A You could perhaps use seismic to determine  
10 whether or not it's a fault.

11 Q All right. The extent of offset -- do you  
12 know what I mean when I use the term "offset"?

13 A Yes.

14 Q And what does that mean?

15 A If you take a fault plain and if you look at  
16 a -- the same point, the same horizon, on each side of  
17 the fault, the offset is how much vertical offset --  
18 or it could be lateral offset -- it's how much that  
19 fault plane has moved. And generally it's a matter of  
20 up or down.

21 Q And how does one, based on wireline logs or  
22 anything other than a core sample, determine as  
23 between two wells that something -- or radioactive  
24 marker that shows no offset or zero foot offset -- how  
25 does that indicate a fault, in your opinion?

1 A If it has zero?  
 2 Q Yes, sir.  
 3 A If you have zero offset, then you would not  
 4 be able to identify it on your wireline logs.  
 5 Q Why would one conclude that a zero offset is  
 6 a fault if -- based on wireline information? How  
 7 would that happen?  
 8 A They would have had to have had some other  
 9 information such as pressure information and fluid  
 10 levels.  
 11 Q Can you classify faults into major and minor  
 12 categories?  
 13 A That's -- that's not done in the application.  
 14 It's not done in TCEQ rules. And geologically -- I  
 15 mean, there's -- you know, I guess theoretically you  
 16 can do anything. It's not done in the application and  
 17 it's not done especially in the TCEQ rules.  
 18 Q Sir, are you an expert in the TCEQ rules?  
 19 A I can read them.  
 20 Q I understand that. Have you ever handled a  
 21 Class I permit application previously?  
 22 A No.  
 23 Q So is it fair to say that other than reading  
 24 them, you have no experience in the requirements of  
 25 the TCEQ rules, do you?

1 A Correct.  
 2 Q So let's stick to geology and your field of  
 3 expertise. Do you -- or are you, as a geoscientist,  
 4 able to distinguish between major and minor faults?  
 5 A It depends upon whose definition -- you have  
 6 to define what you mean by "major" and a "minor"  
 7 fault.  
 8 Q I'm asking you if you have ever in your  
 9 career distinguished between major and minor faults?  
 10 A Yes.  
 11 Q All right. And what criteria did you use,  
 12 sir?  
 13 A It depends upon the project and the scale.  
 14 Q Okay. Let's talk about the most recent  
 15 project you worked on and that you were asked to  
 16 identify major and minor faults. Can you recall that?  
 17 A No, because generally, if we're looking for  
 18 faults, we're looking for faults. We don't classify  
 19 them as major or minor because in hydrogeology --  
 20 Q Sir, I'm asking you if you recall that.  
 21 That's all I asked you.  
 22 A No.  
 23 Q All right. You said that you've done it  
 24 previously?  
 25 A Yes.

1 Q On what occasion?  
 2 A We've looked at faulting in the Floridan  
 3 aquifer.  
 4 Q Okay. So in Florida you've looked at  
 5 faulting and you have used some criteria to  
 6 distinguish in that matter between major and minor,  
 7 correct?  
 8 A No. I said we looked at faulting. We did  
 9 not bother to distinguish between major and minor.  
 10 Q Sir, I've asked you several times now and I'm  
 11 going to try to hone in now, and I'd ask you, unless  
 12 my question calls for something more than a "yes" or  
 13 "no" I'd ask you to confine your answer to a "yes" or  
 14 "no."  
 15 Yes or no, you have in your prior work  
 16 classified faults as major and minor?  
 17 A Perhaps at some time. I don't recall any  
 18 specific --  
 19 Q A moment ago I asked you if you had ever in  
 20 your work been called to classify faults as major and  
 21 minor and you said yes. Now I'm asking to you recall  
 22 those instances so we can establish some criteria and  
 23 you say you don't recall them. Is that correct?  
 24 A I don't recall an instance.  
 25 Q Do you think it is possible and would be

1 useful in some situations to distinguish between major  
 2 and minor faults?  
 3 A In some situations.  
 4 Q In what situations would you consider it to  
 5 be helpful to make that -- to distinguish major and  
 6 minor faults?  
 7 A Well, if you're doing large scale regional  
 8 work, you're looking at fault trends that go across  
 9 counties or maybe go across for hundreds of miles,  
 10 then you're looking at what people would normally call  
 11 major faults. And then when you go out and -- that  
 12 would be stuff you'd look at like on maybe aerial  
 13 photography or long seismic lines.  
 14 And then when you went out on a field  
 15 work, you might find minor faults that are associated  
 16 with those major fault zones. And those, depending  
 17 upon the scale, may be -- you may see evidence in the  
 18 field of anything from faulting down on a matter of a  
 19 couple of inches up to feet or hundreds of feet, and  
 20 major and minor would be relative depending upon the  
 21 project.  
 22 Q Okay. Let's talk about relative major and  
 23 minor faulting. Is a fault that's a hundred -- has  
 24 150 -- 100 to 150 feet of throw or offset, would you  
 25 consider that to be a major fault?

1 A It depends upon your context. I would say,  
 2 it would be a major fault.  
 3 Q And a fault that has, maybe, 20 feet of  
 4 offset, would you consider that to be a major or a  
 5 minor fault?  
 6 A Again, it depends upon your context and what  
 7 you're classifying your fault for. There are cases  
 8 where it could be still a major fault.  
 9 Q Okay. In this case, in the evaluation of  
 10 Exxon data, are you able to distinguish any categories  
 11 of faulting as between -- in the line that we've been  
 12 discussing between major and minor?  
 13 A No, there's no need to.  
 14 Q I understand your position on rules you've  
 15 only read once, sir, but I'm asking you if you can  
 16 give us, as a geoscientist or a geologist, any ability  
 17 to distinguish faults in this case?  
 18 A Distinguish faults as far as major or minor?  
 19 Q Yes, sir.  
 20 A No.  
 21 Q Then it's your opinion that all faults in  
 22 this case are a necessary consideration. Is that  
 23 correct?  
 24 A Yes.  
 25 Q And so even if there's a line drawn by some

1 geologist at some time that shows 20 feet of offset in  
 2 a different horizon other than where the applicant is  
 3 proposing to inject, you still think that is necessary  
 4 for consideration?  
 5 A Yes.  
 6 Q Okay. Now, in your prefiled testimony you  
 7 photograph a number of events that you purport are  
 8 indications of surface faulting. Is that correct?  
 9 A Correct.  
 10 Q Which of those surface faults, as you've  
 11 characterized them, are in the area of review?  
 12 A There is one of them.  
 13 Q Which one?  
 14 A That's the Big Barn, a portion of the Big  
 15 Barn fault.  
 16 Q A portion of the Big Barn fault. Do you have  
 17 your prefiled testimony before you?  
 18 A Yes. We can refer to exhibit -- my Exhibit  
 19 O.  
 20 Q Your exhibit -- why don't we give everyone a  
 21 chance to get there.  
 22 A O.  
 23 Q Now, I see on Exhibit O several circles that  
 24 you've drawn around the proposed wells for TexCom  
 25 which give a little variation in the area of review.

1 I assume those circles are drawn on a 2.5 mile radius.  
 2 Is that correct?  
 3 A Yes.  
 4 Q And are the surface faults that you identify  
 5 in your prefiled testimony, as you just said, only one  
 6 of those faults, the Big Barn East Fault -- or a  
 7 portion of the Big Barn East Fault is in the area of  
 8 review, correct?  
 9 A Correct.  
 10 Q Why did you include the others?  
 11 A Because one of the things that the applicant  
 12 is charged with is you're not --  
 13 Q Again, sir, I'm going to ask you, unless you  
 14 have some other experience in what TCEQ requires, for  
 15 you to explain the indication -- area of review, what  
 16 does that mean to you?  
 17 A The area of review is a two-and-a-half mile  
 18 radius for each of the proposed injection wells.  
 19 Q Yet many of the surface faults that you say  
 20 exist, based on cracks in pavement and what-not are  
 21 outside the area of review, correct?  
 22 A Yes.  
 23 Q And why did you include them?  
 24 A I started to explain that before you  
 25 interrupted me. We looked at what -- the area both

1 within the area of review and outside of the area of  
 2 review to get the regional context. And as it's  
 3 stated in the rules, you're not limited to looking at  
 4 the area of review if you think it necessary.  
 5 Q If you think it necessary, sir?  
 6 A Yes.  
 7 Q If who thinks it's necessary?  
 8 A Well, if the applicant -- it's stated if it's  
 9 necessary to look beyond the area of review. And what  
 10 you see -- the reason I did was because you're in a  
 11 part of Texas where surface faulting is known to  
 12 occur. It's common knowledge within the geologic  
 13 community.  
 14 So we looked at both within the area of  
 15 review and outside of it. Part of the area of review  
 16 we could not drive some of the roads because they're  
 17 part of the Conroe field and they were not -- dirt  
 18 roads and not accessible to the public. Part of these  
 19 roads are not paved, so we drove both inside and  
 20 outside to get a feel and to see if there were even  
 21 surface faults visible in the area.  
 22 Q Sir, are you saying there aren't many roads  
 23 around Conroe and the proposed facility?  
 24 A That's not what I said.  
 25 Q Okay. What did you say?

1 A I'll repeat what I said to you.

2 Q I didn't ask you to repeat it. I asked  
3 you -- sir -- sir --

4 JUDGE WALSTON: Well, don't argue. I  
5 mean, he answered the question and he's trying to  
6 answer it again.

7 MR. RILEY: Okay. Well, let me  
8 rephrase. Thank you.

9 Q (By Mr. Riley) What roads did you drive in  
10 the area of review?

11 A We drove most of the paved roads within the  
12 area of review. But as I said, some of the roads are  
13 not paved. It doesn't do any good to look for surface  
14 faulting on unpaved roads. They don't show up. And  
15 then some of these roads, either paved or unpaved,  
16 were private roads within the Conroe field and we did  
17 not have access to them. So we did not drive those  
18 roads.

19 Q So when I asked you what roads did you drive,  
20 your answer seems to go beyond my question, so I'm  
21 going to ask you again. If you could confine your  
22 answers to the scope of my question -- you'll have an  
23 opportunity if Mr. Walker decides to ask you questions  
24 as follow up. Can we agree on that from this point  
25 forward?

1 A Yes.

2 Q Thank you. Could you find in your -- I  
3 believe it's Exhibit C -- the photograph that relates  
4 to the Big Barn East Fault? It's a series of  
5 photographs. It doesn't seem to have an independent  
6 page number.

7 A It would be the fourth page under Exhibit C.

8 Q All right.

9 A At the top -- the upper-most photograph.

10 Q Has this Big Barn East Fault been named or  
11 recognized in any publication, any geologic paper,  
12 anything other than your testimony in this case?

13 A No publications that I know of.

14 Q So the only place where the Big Barn East  
15 Fault exists is in this photograph and your testimony,  
16 correct?

17 A No.

18 Q Well, please explain.

19 A There are some geologists in the Houston area  
20 who specialize in surface faulting, identification and  
21 delineation of surface faulting.

22 Q But that's not you, is it, sir?

23 A That's right.

24 Q Sir, is there any publication by any of those  
25 geologists that indicate that the Big Barn Fault

1 exists and to what extent it exists?

2 A I answered that previously.

3 Q And the answer is no?

4 A No.

5 Q Okay. Other than your contact with a single  
6 other geologist -- is that correct? You've had one  
7 contact with a geologist that you employed to assist  
8 you in this case, correct?

9 A That's incorrect.

10 Q All right. Please explain.

11 A There were two geologists.

12 Q Okay. One of the geologists that you  
13 reference in your deposition you actually retained to  
14 identify surface faults for you in the Conroe area,  
15 correct?

16 A Correct.

17 Q And what is that geologist's name?

18 A That's Carl Newman (sic).

19 Q Excuse me?

20 JUDGE WALSTON: He couldn't hear you.

21 A Carl Newman (sic)

22 Q And as I understand it, you subcontracted  
23 with Carl Newman (sic) to get his information  
24 regarding his research -- not your research -- his  
25 research of surface faults in the area of review,

1 correct?

2 A That's only partially correct.

3 Q Did you ask Carl Newman (sic) for his  
4 research regarding faults in the area of review?

5 A Yes.

6 Q And the only fault that Carl Newman gave you  
7 was the Big Barn East Fault. Is that your testimony?

8 A No.

9 Q In the area of review, sir?

10 A Within the area of review, yes. But he did  
11 not give that to me. That's where your question is  
12 misleading. He would not give me his data. We went  
13 out and looked. He would not give me his maps, so we  
14 went out and drove the roads and did all the work  
15 again.

16 Q So -- and as I understand your testimony in  
17 your deposition, Mr. Newman has specialized in -- or  
18 is much more knowledgeable of the region around  
19 Houston and the region around the proposed TexCom site  
20 than you are personally, correct?

21 A Yes.

22 Q And he would not give you the information he  
23 has regarding his evaluation of surface faulting?

24 A He would not -- no, that's why we went out  
25 and looked at everything again.

1 Q So he gave you tips as to where to look. Is  
2 that correct?  
3 A Correct.  
4 Q And you identified the Big Barn East Fault.  
5 Is that correct?  
6 A Correct.  
7 Q Is that the way Mr. -- or Dr. Newman, I  
8 assume -- referred to it?  
9 A Yes.  
10 Q How did you define the extent of the Big Barn  
11 East Fault?  
12 A Well, the Big Barn East Fault is really seen  
13 just where it cuts the highway there.  
14 Q So on your map though it seems that you  
15 certainly have drawn a line much greater than I'd say,  
16 what, 20 feet through the roadway?  
17 A Yes.  
18 Q How did you determine the extent of the Big  
19 Barn East Fault?  
20 A We did that for purpose of identification.  
21 Q So one should not look at your Exhibit O and  
22 concluded that that fault actually is shown in the  
23 area of the review. Is that correct?  
24 A No, it's in the area of review when you look  
25 at the circles.

1 Q Well, that's what I'm asking. You said that  
2 you only could tell the extent of the fault based on  
3 the surface cracks in the road, correct?  
4 A Yes.  
5 Q And the surface cracks in the road -- let me  
6 find the Big Barn East again. Is that Exhibit O that  
7 you were looking at earlier?  
8 A Yes.  
9 Q What's the scale of this map? I don't see  
10 it?  
11 A It's bottom right-hand corner above the bar  
12 scale.  
13 Q Okay. The -- it seems as though about  
14 half-inch equals half a mile, correct?  
15 A Yes.  
16 Q All right. How long would you say you've  
17 drawn the line for the Big Barn East Fault?  
18 A It's drawn as a half-mile or longer.  
19 Q But I thought I just understood you to say  
20 that you could only determine the extent of the Big  
21 Barn East Fault by the cracks in the payment that you  
22 show in your picture and no further information  
23 exists?  
24 A Yes.  
25 Q So it would seem that the extent of the Big

1 Barn East Fault is 20 feet as best you can tell?  
2 A Yes.  
3 Q So the line that you've drawn on here is not  
4 representative of the extent of the fault and may  
5 indeed not be even inside the area of review, correct?  
6 A It may not be, but it may be much longer than  
7 what we've drawn.  
8 Q Okay. But we're going to go with what you  
9 know, sir, not what you think --  
10 A Yes.  
11 Q Based on your information and your evaluation  
12 of the Big Barn East Fault, the best you could say is  
13 it extends 20 feet across the roadway and is evidenced  
14 by the cracks that you show in your photograph?  
15 A Yes.  
16 Q Would that be true if I went through each of  
17 the other faults on this map -- your surface faults --  
18 would it be true that the lines are not representative  
19 of the actual extent of faulting or are drawn to --  
20 are not drawn to scale. Is that correct?  
21 A Correct.  
22 Q Let's talk about the depth of these surface  
23 faults. I believe you told me in your deposition that  
24 in your professional geologic opinion, these faults  
25 extend from the surface of the ground down thousands

1 of feet into the Willcox formation. Is that your  
2 opinion?  
3 A Correct.  
4 Q On what do you base that opinion, sir?  
5 A I base it upon the fact that when you look at  
6 other mapping that has been done in the field, you see  
7 faulting at approximately 500 feet below the surface.  
8 You see faulting in the lower part of the Jackson  
9 formation at about 5,000 feet. You see faulting at  
10 different intervals within the Cockfield, and then you  
11 see deeper faulting on some regional maps. And when  
12 you talk to the geologists who specialize in  
13 identifying surface faults, if they're working a new  
14 area --  
15 Q I'm going to object --  
16 A I'm answering the question --  
17 MR. RILEY: I'm going to object -- no,  
18 I'm going to object because now you're about to  
19 testify about what some other geologist who  
20 specializes. That's not you. Is that correct?  
21 A That's correct.  
22 JUDGE WALSTON: I think your question,  
23 though, was what does he base it on, and he is  
24 testifying that's what --  
25 MR. RILEY: That's fair enough, Judge.

1 Thank you.

2 JUDGE WALSTON: It's not for the truth  
3 of the matter, but --

4 MR. RILEY: I understand.

5 JUDGE WALSTON: Go ahead.

6 A These geologists who specialize in surface  
7 faulting, if they're working an area they have not  
8 worked before, one of the first things they will do is  
9 to go to some of these -- any subsurface maps they  
10 have available, even though they're on much deeper  
11 horizons, and they'll look and see if there's any  
12 faulting identified on the maps. And then they know  
13 at about what angle the faults normally are. So you  
14 can do your trigonometry, and if you're at, say, 8,000  
15 feet below the surface and you know the fault is maybe  
16 45 to, say, 60 degrees or so, you can project where  
17 you would see it at the surface.

18 So one of their standard methods of  
19 operation, one of the things they do, is to project  
20 that deep fault to the surface, and then they go and  
21 look and see if they can find that fault on the  
22 surface. And quite -- not all the time, but quite  
23 often they do. And then they will also drive the  
24 roads in the area, look at the aerial photography, do  
25 all those types of things and see if you can find

1 additional evidence of surface faulting.

2 Q Doctor, did you do any of that work?

3 A Do any of -- we looked at the -- we looked at  
4 the deeper horizons. We drove the roads to look for  
5 them, and we looked at the aerial photography.

6 Q Sir, if I understood you correctly, that --  
7 you were making a motion with your arm indicating that  
8 faults occur at angles, correct?

9 A Correct.

10 Q Now, as I -- if I were a bird or, as we say,  
11 a bird's eye view looking down on a fault --  
12 correct --

13 A All right.

14 Q -- that, as you say, you find at the surface,  
15 if you do the trigonometry -- as you just said to the  
16 Judges -- where would that fault be located, say, at  
17 6,000 feet? Where would you find the deep fault that  
18 corresponds to the surface fault that you claim  
19 correlates in some instances?

20 A It would depend upon the angle of the fault.

21 Q All right. And what do you understand the  
22 angles of the faults to be in the Conroe area? Is  
23 there a common angle?

24 A There's not a common angle. That's why I  
25 said they can be 45 degrees, they can be 60 degrees.

1 They can be higher. But if you're alerted to faults  
2 in the subsurface, then you go up dip and it will be a  
3 swath, it will be a path, maybe a couple of thousand  
4 feet that you've got to look at and you'll look for  
5 any evidence. I can't give you an exact location of  
6 where that fault is going to be, sir.

7 Q Well, sir, that's why I'm asking you. So  
8 then -- it would seem to me then, based on your  
9 testimony, that surface faults, to the extent that  
10 they are relevant at all, would only be after you did  
11 an evaluation to see whether or not, one, they exist  
12 in the subsurface and, two, whether they exist in the  
13 area of review. Because the surface fault in an area  
14 of review would certainly not be found in the  
15 subsurface in the same place, correct?

16 A Correct.

17 Q So showing surface faults in the area of  
18 review would not indicate faulting in the deep stratum  
19 in the area of review?

20 A It depends upon where your surface fault was  
21 located.

22 Q Well, and I'm following you, but if I take  
23 the surface fault and I do trigonometry at a 45-degree  
24 angle, let's say, what distance from the surface  
25 manifestation would I be before I found the subsurface

1 manifestation?

2 A It depends upon -- I said depends on -- are  
3 you talking about a particular fault or --

4 Q Well, I'm trying to understand what your  
5 testimony is regarding the surface faults. And you've  
6 just explained that you don't find them -- they're not  
7 perpendicular, right? There's no fault that occurs at  
8 a 90 degree angle, correct?

9 A Well, there are -- there can be faults that  
10 are perpendicular. These are probably at some angle.

11 Q Okay. So again, if I took your surface  
12 fault -- and is there a trend in terms of which side  
13 of the fault would be up thrown and which side would  
14 be down thrown?

15 A Many of the faults are down thrown on the  
16 Gulf Coast side, but that is not always the case, and  
17 especially when you're looking on top of a salt dome  
18 there is not a -- you have to look at the -- each  
19 individual fault and see what's the down thrown side.

20 Q Okay. Other than identifying surface faults,  
21 is there any relevance to the deep stratum that  
22 underlie the TexCom site that one could draw? I mean,  
23 in other words, is it your postulate that those  
24 surface faults indicate faulting in the deep stratum,  
25 specifically the lower Cockfield?



1 A Yes.

2 Q And how do you draw that conclusion, sir?

3 A As I stated earlier, you see faulting from  
4 the surface at various depths into the subsurface all  
5 the way down into the upper Cockfield, which is where  
6 most of the -- then on a regional basis you see some  
7 faulting in the lower Yegua, which is down at the  
8 level of the lower Cockfield or even lower.

9 Q Well, what causes a fault? In the various  
10 maps that you looked at, is it fair to say that some  
11 maps show certain faults and other maps don't show  
12 them. Is that a fair statement?

13 A That's correct.

14 Q Why is that?

15 A It can be a function of several things. It  
16 can be a function of the well control that was used.  
17 It can be a function of the data, the vintage of the  
18 map. At certain times -- let's stick with the Conroe  
19 field -- through the years, through the decades, they  
20 went back and gathered additional logs and additional  
21 data from certain wells. New technology came along  
22 and they were able to run what are called cased hole  
23 logs.

24 So, for instance, the applicant has  
25 based their fault identification on the 1936 map. By

1 the '70s, the oil field had developed gamma ray logs  
2 and also what are called pulse neutron logs. And as  
3 they were developing problems in the field, they had  
4 to get a better handle on the subsurface structure of  
5 the field.

6 So Exxon -- Humble Exxon -- went in and  
7 logged many of these wells with these gamma ray logs  
8 and with the pulse neutron logs. And that gave them  
9 just reams of new information that they didn't have  
10 for the 1936 map.

11 Thirty years -- I mean, 40 years later  
12 in the mid '70s, they had a lot of pressure data that  
13 they did not have with the 1936 map that the  
14 application is based on. This pressure data showed  
15 them that the field is very compartmentalized. So  
16 they came up and identified 144 different compartments  
17 within the field, and they attributed many of these to  
18 faulting. Some of them could be due do stratigraphic  
19 pinch outs, but they called these fault blocks within  
20 the field.

21 Q How many fault blocks are there, did you say?

22 A In 19 -- in the 1975 paper they identified  
23 144.

24 Q And how large are these fault blocks?

25 A They're varying size.

1 Q Give me the variation, sir?

2 A We'd have to go back and look at the map.  
3 They would vary from just a few well locations up to  
4 hundreds of acres.

5 Q And in the area of the TexCom site, the area  
6 of review, what fault block, if any, did Exxon  
7 identify?

8 A Within the area of review they identified a  
9 number of these fault blocks, scores of these fault  
10 blocks.

11 Q Scores?

12 A Yes.

13 Q All right. And in what record that you've  
14 introduced into evidence reflects the scores of fault  
15 blocks in the TexCom area of review?

16 A It's in the 1975 Journal of Petroleum  
17 Technology Paper, but also in the various exhibits  
18 that Exxon provided in '72 and in '79 at Railroad  
19 Commission hearings.

20 Q Okay. I'm going to ask you, again, as  
21 precisely as you can, tell me the number of fault  
22 blocks in the area of review identified in those  
23 materials?

24 A I don't have a count on them. Exxon  
25 identified 144 fault blocks for the Conroe field.

1 Q How large is the Conroe field?

2 A It's about -- I think about seven miles long  
3 and about five miles wide.

4 Q So in seven miles long and five miles wide,  
5 assuming that to be correct, you're saying that there  
6 are 144 fault blocks, correct?

7 A That's what Exxon identified.

8 Q Okay. Do you disagree with Exxon? Do you  
9 agree with Exxon? Did you look at any back-up  
10 information or just their summary reports?

11 A I accept their publication.

12 Q All right. What is the significance of these  
13 fault blocks in this matter?

14 A Well, the applicant is charged with examining  
15 any faults within the area of review.

16 Q We're going to come to that, sir. But I'm  
17 asking you: What is the significance of the number of  
18 fault blocks? You throw it out as if it has  
19 significance because it sounds like a lot, 144. What  
20 is the specific significance of the fault blocks?

21 A And I was starting to answer that question --

22 Q No, you were --

23 JUDGE WALSTON: -- asked him the  
24 significance of the number of the fault blocks or of  
25 the fault blocks --

1 MR. RILEY: Well, I was going to ask the  
2 number of fault blocks. He keeps referring to the  
3 number of fault blocks.  
4 JUDGE WALSTON: Sir, on your answers you  
5 keep trailing off and --  
6 MR. RILEY: I'm sorry --  
7 JUDGE WALSTON: -- tell the significance  
8 of fault blocks.  
9 MR. RILEY: I'm sorry, Judge.  
10 Q (By Mr. Riley) Here's what I want to  
11 understand, Mr. Collier. I'll withdraw the question  
12 and try to rephrase.  
13 I want to understand when you throw out  
14 the number 144 whether the number of fault blocks has  
15 any significance by itself?  
16 A Yes.  
17 Q Okay. And in what regard does the number of  
18 fault blocks identified by Exxon in the papers you've  
19 mentioned have for this application?  
20 A Because it shows, as you would expect with a  
21 salt dome structural field -- it shows how complicated  
22 it is and it shows how faulted it is, and that is what  
23 the applicant is charged with looking at. They are  
24 charged with looking at any and all faults -- and not  
25 just faults, but when you read their instructions,

1 they're even charged with looking at fractures. And a  
2 fracture is a break in the rock in which there has  
3 been no vertical displacement.  
4 So the significance is to the number and  
5 to the -- whether you want to worry about the number  
6 or not, or whether you want to just talk about the  
7 significance of fault blocks is that this is what you  
8 have to look at to characterize the subsurface for  
9 this type of application. And this is the baseline  
10 data that you've got to have before you can do  
11 reservoir modeling. Because if you do reservoir  
12 modeling on the wrong size block --  
13 JUDGE WALSTON: -- I think you are  
14 getting far from the question now.  
15 WITNESS COLLIER: All right.  
16 Q (By Mr. Riley) Doctor, are there faults --  
17 again, I'm trying to drill down on the lines you drew  
18 on the map, specifically on page -- or Exhibit 1P --  
19 whether those indicate these fault blocks or faults  
20 associated with these fault blocks in detail. In  
21 other words, are those all the faults that you say  
22 exist in the area of review?  
23 A Those are all the faults that we found in the  
24 public records that we had access to.  
25 Q And by "public records" you're also including

1 the Geomap private company record that you purchased,  
2 correct?  
3 A Correct.  
4 Q So, again, the number of fault blocks and  
5 Exxon's description of them, all of that information  
6 as it pertains to the area of review is contained in  
7 your Exhibit 1P, correct?  
8 A You would not have 144 fault blocks. Of  
9 course we limited our -- the faults we delineated to  
10 the area of review.  
11 Q What I'm trying to get to is that -- and I  
12 apologize if I seem vague -- but I'm wondering if the  
13 fault blocks that Exxon identified are different from  
14 the fault lines that you've drawn on Exhibit 1P?  
15 A Some of them may be. Many of them would  
16 be -- I would think would be correlatable.  
17 Q Okay. So there's a set of information that  
18 you've described that you did not plot on 1P. Is that  
19 your testimony?  
20 A Exxon may have additional data.  
21 Q Based on the records you reviewed and as  
22 you've described, all I'm trying to understand is  
23 within the area of review, are those the faults that  
24 you say exist based on the Exxon data and the other  
25 sources that you looked at?

1 A Yes.  
2 Q Is it a complete list?  
3 A Complete list is --  
4 Q Based on the data you've reviewed -- and I'll  
5 do the preamble again -- but all the data you reviewed  
6 is your description on Exhibit 1P complete?  
7 A Yes.  
8 JUDGE WALSTON: Why don't we go ahead  
9 and take a break now. We've been going an  
10 hour-and-a-half.  
11 MR. RILEY: Thank you.  
12 JUDGE WALSTON: So we'll take a  
13 15-minute break and resume at 10:45.  
14 (Recess: 10:30 a.m. to 10:48 a.m.)  
15 (TexCom Exhibit No. 73 marked)  
16 JUDGE WALSTON: Back on the record.  
17 Mr. Riley?  
18 MR. RILEY: Thank you, Judge.  
19 Q (By Mr. Riley) Dr. Collier, could you look at  
20 what I've drawn, again rather crudely on the easel --  
21 or the paper on the easel behind you?  
22 A Yes.  
23 Q Are you able to make out what I'm attempting  
24 to depict in that diagram?  
25 A Yes.

1 Q All right. As you can see, what I've done is  
2 I tried to illustrate some portions of our discussion  
3 before the break as to how faults would be found at  
4 different horizons if indeed it extended -- or a fault  
5 extended through the various horizons. So if you'll  
6 follow with me, at the surface, which I think I've  
7 labeled No. 1 in the diagram. Then I made up a  
8 hypothetical horizon -- our first horizon which I  
9 labeled No. 2 and then a hypothetical horizon or  
10 second horizon that I labeled No. 3. Do you see that?

11 A Yes.

12 Q Now, if I drew a circle, a bird's eye view  
13 circle, over that geographic area -- again looking in  
14 two dimensions -- is it correct to say that I would  
15 see the fault line move in terms of geographic  
16 relationship across the circle as I went deeper?

17 A Yes.

18 Q All right. So if I have a fault at the  
19 surface of -- in a particular location, if it did  
20 indeed extend down into the subsurface, then as you  
21 said earlier it's a matter, to some degree, of  
22 trigonometry in figuring out where one would find it  
23 in the subsurface, correct?

24 A Yes.

25 Q And that -- my summary circle at the bottom

1 there is showing, again, in a bird's eye view, that if  
2 I was able to map accurately a fault that extended, as  
3 I've drawn it, I would actually show three lines  
4 moving across that circle, correct?

5 A Correct.

6 Q Now, let's talk about your Exhibit 1P. Am I  
7 correct that you did not attempt to correlate any of  
8 the subsurface faults to any of the surface faults  
9 that you describe in your testimony?

10 A Correct.

11 Q And am I also correct that regardless of  
12 whether you start at the surface or you start in a  
13 horizon, if the fault indeed extends downward or  
14 upward and you map a different horizon, you'd get the  
15 same phenomena that is depicted in the diagram  
16 Applicant's Exhibit 73?

17 A Correct.

18 MR. RILEY: And by the way, Judges, I've  
19 premarked that diagram as Applicant's Exhibit 73 and  
20 I'd offer it into the record as a demonstrative  
21 exhibit.

22 JUDGE WALSTON: Any objection?

23 There being no objection, Applicant's  
24 Exhibit 73 is admitted for demonstrative purposes  
25 only.

1 (TexCom Exhibit No. 73 admitted)

2 Q (By Mr. Riley) Doctor, is it fair to say  
3 then, if we are concerned with faulting in the  
4 injection zone that the best evidence of whatever  
5 type -- wireline, boring logs, well control --  
6 whatever method one would use to describe faulting in  
7 the injection zone, the -- that's the interval of  
8 concern. Would you agree?

9 A Interval of concern as far as what?

10 Q Well, you've mentioned reservoir modeling.

11 And while you know nothing about reservoir modeling,  
12 you said that faults were important for reservoir  
13 modeling purposes, correct?

14 A Correct.

15 Q All right. So one could assume that even  
16 with your basic knowledge of reservoir modeling, that  
17 the faults in the injection zone are the ones that  
18 will affect the modeling, correct?

19 A Correct.

20 Q So is it fair to say, then, for purposes of  
21 reservoir modeling that those are the faults we should  
22 be looking at?

23 A Yes.

24 Q Now, having said that, those -- as we have  
25 depicted on the board, those faults could move in and

1 out of the injection shown? In other words, you might  
2 find them at a higher stratum, but depending on the  
3 slope and depending on the trigonometry depicted, you  
4 may not find it, it may not exist, in the injection  
5 zone. Is that correct?

6 A No.

7 Q Within the area of review? Maybe I wasn't  
8 specific enough.

9 JUDGE WALSTON: Maybe you better restate  
10 the question.

11 MR. RILEY: I'm sorry.

12 Q (By Mr. Riley) I didn't try to draw this in  
13 the diagram, but let's assume that I started with a  
14 fault for purposes of our discussion to the northeast  
15 and assume that the diagram now has north to the top,  
16 south to the bottom, west to the left and east to the  
17 right? Is that fair?

18 A (Indicating)

19 Q Yes, that's fine. Yes. Okay?

20 A All right.

21 Q Now, if I started closer to the northwest  
22 side of the circle, by the time I got down to the  
23 injection zone, the fault could have moved or would  
24 have moved outside of the circle or outside of the  
25 area of review, agreed?

1 A That's possible.  
 2 Q So we are again concerning ourselves in terms  
 3 of reservoir modeling with faults in the injection  
 4 zone that could affect the modeling, correct?  
 5 A Correct.  
 6 Q So that is the horizon of concern. Would you  
 7 agree with me so far?  
 8 A Correct.  
 9 Q So if I have faulting information, say, from  
 10 the surface, it's not particularly relevant for any  
 11 purpose regarding reservoir modeling. Would you  
 12 agree?  
 13 A Well, depends upon where it is on the  
 14 surface.  
 15 Q Okay. Again, using the trigonometry and --  
 16 again, I'm even going to go with you that all these  
 17 faults go from the center of the earth to the surface  
 18 and that they are findable or identifiable in the  
 19 subsurface. But if it moves out of the area of review  
 20 because of the trigonometry, then it's not of concern  
 21 for reservoir modeling?  
 22 A Correct.  
 23 Q The mapping -- of all the data sources you  
 24 looked at, which do you consider the most reliable?  
 25 A It would be the Exxon data.

1 Q Any particular report? Because the Exxon  
 2 data is inconsistent even within itself, correct?  
 3 A I would not use the word "inconsistent."  
 4 Q It changed over time?  
 5 A Their -- different maps may show different  
 6 faults.  
 7 Q Okay. Well, then, I think you'll give me, at  
 8 least, that -- let's say in 1972 where the Exxon map  
 9 showed a fault, if it didn't reappear, say, in the  
 10 later Exxon mapping, what would you speculate occurred  
 11 in that interval or in that time interval?  
 12 A I don't believe the fault has disappeared.  
 13 Q Do you think Exxon just neglected to map it  
 14 again?  
 15 A They may have. It depends upon the purpose  
 16 for which their later map was made.  
 17 Q So you would agree with me that all of  
 18 Exxon's mapping, the entirety of Exxon's mapping,  
 19 depends on what Exxon's motivation was in developing  
 20 the map?  
 21 A Yes.  
 22 Q Now, despite not knowing Exxon's motivation  
 23 or whether there were contrary maps offered in those  
 24 Railroad Commission proceedings, the source of  
 25 information, both for the applicant and for your

1 analysis, depends heavily on the Exxon mapping,  
 2 correct?  
 3 A Correct.  
 4 Q And is that primarily because Exxon, having  
 5 been -- Exxon and its predecessors -- having been in  
 6 that field so long had the longest history of  
 7 attempting to map or identify issues in the Conroe  
 8 field?  
 9 A Correct.  
 10 Q Is it true that on all of Exxon maps, the  
 11 entirety of Exxon's analysis, the faults that the  
 12 Applicant put on it -- in its application show up in  
 13 each case?  
 14 A I believe they do, yes.  
 15 Q All right. So at least we can agree, I hope,  
 16 that the faults that the applicant depicted on its --  
 17 in its area of review, were consistently mapped by  
 18 Exxon in the Conroe field in the area of review?  
 19 A Yes.  
 20 Q Do you have any disagreement with where the  
 21 applicant drew those faults on its maps?  
 22 A No.  
 23 Q Would you agree that as -- well, let me say  
 24 it differently. I don't want to get into qualitative  
 25 statements, but would you agree that the off -- the

1 throw or the off-set for the -- what I'll call Fault  
 2 No. 1 -- although there's probably a better way to  
 3 refer to it -- which is the fault that extends to the  
 4 southeast of the site across the area of review and is  
 5 the longest line on the applicant's map, the big red  
 6 fault. Do you see that one?  
 7 A Yes.  
 8 Q Would you agree with me that the throw on  
 9 that fault is somewhere between 100 to 150 feet?  
 10 A I'll accept that.  
 11 Q Does that correspond with your review of the  
 12 Exxon data?  
 13 A Yes.  
 14 JUDGE EGAN: Could you speak up a little  
 15 bit, please?  
 16 WITNESS COLLIER: Yes.  
 17 JUDGE EGAN: Thank you.  
 18 JUDGE WALSTON: Can I ask you a  
 19 question, Mr. Riley?  
 20 MR. RILEY: Certainly.  
 21 JUDGE WALSTON: Are you talking about  
 22 this line here?  
 23 MR. RILEY: It is the big red line, yes.  
 24 Unfortunately I haven't come up with a better way to  
 25 refer to it. It's the -- you're exactly right, Judge.

<p style="text-align: right;">Page 927</p> <p>1 JUDGE WALSTON: Okay. My question is I  2 thought you said on the applicant's map. I thought  3 this was his map.  4 MR. RILEY: It also appears on the  5 applicant's map.  6 JUDGE WALSTON: Okay.  7 Q (By Mr. Riley) The second fault that the  8 applicant identified -- and it is referred to in your  9 legend as the -- again marked in red further south and  10 a little further east of the fault we were just  11 discussing -- is the second fault identified by the  12 applicant, correct?  13 A Correct.  14 Q And do you know the throw on that fault?  15 A No.  16 Q Does it sound correct that it would be in the  17 nature of 400 feet?  18 A I'll accept that.  19 Q Before you accept it, let me make sure of  20 my -- I think that's correct based on the applicant's  21 representations and the Exxon information.  22 Was it fair to say, Doctor, that all the  23 other faults drawn on Exhibit 1P are substantially  24 less in terms of offset or throw than the numbers we  25 just discussed?</p>	<p style="text-align: right;">Page 929</p> <p>1 MR. RILEY: Judge, you probably can see  2 that a little better on TexCom Exhibit 72.  3 JUDGE EGAN: I've got it right here.  4 MR. RILEY: Okay. The throw is the  5 vertical travel.  6 JUDGE EGAN: I understand. But I just  7 wanted to make sure I knew what your nomenclature  8 meant.  9 MR. RILEY: I understand. Thank you.  10 Q (By Mr. Riley) And we've been using two  11 terms "throw" and "offset" and I apologize to everyone  12 for doing that, but let's stick with offset as best we  13 can, Dr. Collier. Are those synonymous in terms of  14 our discussion?  15 A That would be fine.  16 Q All right. Now, it was marked -- I'd ask  17 that the last piece of paper handed out be marked as  18 TexCom Exhibit 74.  19 Doctor, could you take a moment and just  20 take a look at what's been marked as Applicant Exhibit  21 74? And I think you'll see that it's -- unfortunately  22 I didn't have time to make it more neat or -- more  23 neat, but as an attempt to label with a number each of  24 the segments you've depicted on your Exhibit 1P.  25 A I've looked at it.</p>
<p style="text-align: right;">Page 928</p> <p>1 A I don't have the -- the throw on each one of  2 those faults compiled.  3 Q Well, fortunately, I've taken the time to do  4 that for you, and let me get an exhibit passed out and  5 then let's resume our discussion.  6 (TexCom Exhibit No. 74 marked)  7 JUDGE EGAN: Would it be okay to ask a  8 clarifying question just so I make sure I understand  9 that testimony before it begins?  10 MR. RILEY: Of course. Yes.  11 JUDGE EGAN: I just want to get some  12 nomenclature right. When y'all were talking about  13 "throw," are you talking about the angle of the fault  14 or are you talking about the depth of the fault or --  15 WITNESS COLLIER: The amount of movement  16 along the fault line.  17 JUDGE EGAN: So how much difference  18 there is between --  19 WITNESS COLLIER: If you take this right  20 here, this horizon, if it moves down 20 feet, we have  21 20 feet of throw. So it can be 20 feet lower than  22 where it is --  23 JUDGE EGAN: Okay. So 400 feet of throw  24 is how much they've separated from each other?  25 WITNESS COLLIER: Yes.</p>	<p style="text-align: right;">Page 930</p> <p>1 Q All right. And just because I don't want to  2 create a misimpression, there are some highlighted  3 segments that we had some difficulty correlating to  4 the Exxon data and would -- meaning nothing untoward,  5 we have labeled with a highlighter and our little  6 handwritten legend is "fictional." And I don't mean  7 to be deprecating. It may be that we just couldn't  8 find it in the Exxon data, but at least we had trouble  9 correlating your line to any of the support materials.  10 MR. WALKER: Your Honor, at this time, I  11 would object. Although this item has not been offered  12 into evidence, I would object to that editorial  13 comment as being a comment upon the evidence as  14 opposed to something helpful to the Court.  15 JUDGE WALSTON: If I understood  16 correctly, he might have picked a better word than  17 "fictional," but he was at least just explaining --  18 MR. RILEY: Yes, sir. In fact, that was  19 the reason I didn't want it to be anything more than  20 what we intended it to be, which was our difficulty in  21 locating the lines that Dr. Collier drew.  22 Q (By Mr. Riley) Dr. Collier, let me ask you a  23 preliminary question. Did you draw the lines on this  24 map?  25 A No.</p>

1 Q Who did that work?  
 2 A I had my staff compile this.  
 3 Q And who among your staff do you know who  
 4 actually worked on this diagram?  
 5 A Zack Irwin.  
 6 Q Is that it? Mr. Irwin?  
 7 A Lynn Smith. And then I reviewed all of  
 8 the -- after they marked it, I looked at all of them.  
 9 Q Okay. So is it fair to say then, after these  
 10 individuals compiled the exhibit, that you checked the  
 11 work and you stand by it here today?  
 12 A Yes.  
 13 Q Okay. And at least in terms of methodology,  
 14 do you see what I attempted to do in labeling each of  
 15 the segments you drew with numbers?  
 16 A Yes.  
 17 Q And I came up with -- well, I shouldn't take  
 18 credit for others' work. My colleagues and I came up  
 19 with a total number of 31.  
 20 A Yes.  
 21 Q Now, our numbers 30 and 31 refer to the  
 22 faults that were identified by the applicant, and  
 23 Dr. Langhus specifically, that we depicted in the  
 24 application and have discussed several times this  
 25 morning, correct?

1 A Correct.  
 2 Q So 30 and 31 are just your reflection of the  
 3 faults identified by Dr. Langhus and the applicant in  
 4 the application, correct?  
 5 A No.  
 6 Q I'm sorry.  
 7 A The applicant and the application did not  
 8 identify most of these faults.  
 9 Q No, I'm saying 30 and 31, sir.  
 10 A Oh, 30 and 31, yes.  
 11 Q Yes.  
 12 A Yes. Yes.  
 13 Q And then the rest of the items in this record  
 14 are what you and your staff have added and you stand  
 15 by here today?  
 16 A Yes.  
 17 Q Now, of the remaining faults depicted on your  
 18 Exhibit 1P, are you able to go by number and tell us  
 19 the offset for each of those faults?  
 20 A No.  
 21 Q Is that something that one could do based on  
 22 the Exxon data?  
 23 A Yes.  
 24 Q You would have no data that contradicted the  
 25 Exxon data, so whatever the Exxon data showed in terms

1 of offset, if these faults do -- indeed do exist in  
 2 the injection zone, then it would be the Exxon data we  
 3 would rely on for evaluation of these faults, correct?  
 4 A Yes.  
 5 Q Now, let's start, if you don't mind, with --  
 6 well, let me ask a more general question.  
 7 A Okay.  
 8 Q I know that you don't have it -- have the  
 9 data on a fault or a segment-by-segment basis, but can  
 10 you say in general terms what the maximum offset for  
 11 all the other faults depicted on your Exhibit 1P, what  
 12 is the highest offset that is reflected in your  
 13 exhibit?  
 14 A I couldn't tell you offhand.  
 15 Q All right. The other day when Dr. Langhus  
 16 was testifying -- I don't think you were present for  
 17 the hearing in Conroe -- Dr. Langhus talked about the  
 18 consistency that one would expect to see in the  
 19 Jackson shale formation. In other words, what does it  
 20 look like when -- if you were to pull up a wellbore  
 21 and look at that consistency. Do you have an opinion  
 22 on what the Jackson shale consistency would be or some  
 23 common reference you could help us with?  
 24 A It's predominantly shale or clay or mudstone.  
 25 It has little scattered sand lenses -- a few -- very

1 few -- sand to silty lenses in it. But the vast  
 2 majority of it, 90-something percent is mudstone.  
 3 Q All right. And to the layperson, mudstone  
 4 seems contradictory, but if I held a sample, let's  
 5 say, out of a wellbore in my hand, can you tell me  
 6 what the consistency would be like?  
 7 A It would be a clay or mud.  
 8 Q Would playdough be a reasonable way to  
 9 describe how it would seem to a lay person?  
 10 A I guess you could use that. Or if you've  
 11 been out in the field and gotten muddy boots and the  
 12 mud sticks on your shoes, that's what we're talking  
 13 about.  
 14 Q All right. So it would seem to be something  
 15 that would not -- something -- it seems to be a  
 16 stratum that would not transmit energy very  
 17 effectively.  
 18 A By "energy" you mean fluid?  
 19 Q No, I'm saying -- by "energy" I mean energy.  
 20 If someone were to hit, I guess, a bucket of mud, it  
 21 would seem to me that the bucket of mud would  
 22 dissipate the energy from a hammer hit so that it  
 23 doesn't necessarily even penetrate down into the deep  
 24 -- or to the bottom of the bucket.  
 25 A Well, I know what you're trying to get at,

1 but it will transmit energy. That's the whole theory  
2 and practice behind seismic is that you can -- you can  
3 transmit energy through it. Otherwise you would not  
4 been able to do seismic profiling.

5 Q Well, and seismic profiles are a matter of  
6 bouncing energy off of rock stratum and receiving the  
7 echo back and being able to make distinctions like  
8 what's mudstone, what's limestone, what's hard rock,  
9 things of that nature, correct?

10 A But your question was: Would it transmit  
11 energy? And to get to the underlying layers below a  
12 mudstone you have to transmit energy through the  
13 mudstone in order to get that energy below. So while  
14 mudstones do attenuate or while they do weaken the  
15 signal, energy will be transmitted through a mudstone.

16 Q Okay. And I'm sorry, I didn't mean to -- I  
17 wasn't really referring to seismic. I was more  
18 thinking about -- well, you've probably seen those  
19 fellows who, you know, either with their head or with  
20 their hand break bricks?

21 A That's seismic energy.

22 Q All right. And if one of those bricks was  
23 mud, would you expect the same result? In other  
24 words, doesn't some -- isn't there some factor  
25 associated with the brittleness of the material that

1 is struck?

2 A Yes, it would transmit a lot less energy.

3 Q So that would be fair then to say that the  
4 Jackson shale, a thousand foot in the area of the  
5 proposed TexCom well, would transmit energy, say, from  
6 above much less effectively than, say, a granite  
7 layer. Would you agree?

8 A True.

9 Q Would you expect any cracks in the Jackson to  
10 seal themselves if there were a crack in the Jackson  
11 shale?

12 A They may or may not. You have to look at the  
13 evidence -- the local evidence.

14 Q Fair enough. But as a matter of just the  
15 consistency of the formation itself -- at least I can  
16 imagine in my head -- it being difficult to keep the  
17 mud from merging back into itself.

18 A That's why studies have been done to see  
19 whether or not mudstones -- faulting in mudstones can  
20 be transmissive or not.

21 Q I understand that. But would you agree with  
22 me, at least on a consistency basis, that a mudstone  
23 is more likely to reform and seal than, say, a granite  
24 stone?

25 A Yes.

1 Q Now, would you define -- or would you  
2 describe the Jackson shale formation as a significant  
3 confining layer as it exists around the TexCom  
4 facility?

5 A It is a potential significant confining  
6 layer.

7 Q And a thousand feet of mudstone would seem to  
8 be pretty impermeable to fluid transfer. Is that  
9 fair?

10 A To the layman it would.

11 Q Well, how about to the geologist? As between  
12 sand and shale, which is more permeable?

13 A The sand is more permeable.

14 Q And as between sand and shale, would water  
15 tend to permeate the sand much more readily than the  
16 shale?

17 A The sand.

18 Q And can we assume that the rules that we all  
19 know fairly well in other contexts of the path of  
20 least resistance is where you would find the water or  
21 fluid traveling in a relative sense? In other words,  
22 you would expect, if something was bounded by shale on  
23 one side and a shale on the other side and sand in the  
24 middle, would you expect the water to transmit in the  
25 sand preferentially?

1 A Yes.

2 Q Let's go back to the exhibit -- Exhibit 74.  
3 Which of these markings indicate horizons mapped above  
4 the Jackson shale?

5 A Above the Jackson shale is just the one  
6 horizon, which is the -- it's the orange layer, top of  
7 Pliocene from Exxon Mobil 2002.

8 Q Okay. The orange layer --

9 A Well, it's orange color --

10 Q Orange color --

11 A -- so orange lines.

12 Q So the orange lines are -- I'm sorry, the one  
13 I have in front of me it's very difficult to read the  
14 legend. The legend hasn't been changed. It's from  
15 your Exhibit 1P, correct?

16 A Yes.

17 Q Let me just take a moment --

18 A -- second from the bottom is the orange  
19 color.

20 Q Okay. Let me just take out 1P. It will be  
21 easier for me to refer to it. Okay.

22 Again referring to your legend -- now  
23 that I can see it -- as you said, the indication is  
24 that the orange lines depict a mapping or horizon  
25 which is called the top of the Pliocene --

1 A Pliocene.

2 Q -- Pliocene, I'm sorry. And what does that  
3 mean to us lay folks as to where the -- where the  
4 horizon was mapped?

5 A This is approximately 500 feet below the  
6 surface.

7 Q So it's still a good distance, again looking  
8 at exhibit -- I'm not sure the exhibit has depths or  
9 thicknesses -- but it's still substantially above the  
10 Jackson shale formation, is it not?

11 A Correct.

12 Q The -- I note that -- I'm sorry, let me ask a  
13 different question first.

14 Are all the other faults that you depict  
15 on the exhibit, Exhibit 1P, mapped below the Jackson  
16 shale?

17 A All the other colors except that the --

18 Q And I'll call your attention to the dark  
19 green line. I'm not sure I have it correct, but is  
20 that also mapped below the Jackson shale?

21 A Yes. There are some of them that are mapped  
22 in the Jackson shale --

23 Q Okay.

24 A And that is the -- oh, that would be -- well,  
25 let me get -- the purple.

1 Q The purple are mapped in the Jackson shale?

2 A Yes.

3 Q All right. So at least the orange then we  
4 could say are well above, correct?

5 A Correct.

6 Q The top of the -- I don't guess top is the  
7 right way to say it -- but the depth perhaps to the  
8 upper Cockfield is 5,134 feet. You said you accepted  
9 that from the application previously, correct?

10 A Yes.

11 Q So the orange lines down to the top of the  
12 upper Cockfield are some 4600 feet?

13 A Approximately.

14 Q Tell me, if you can -- and actually we're  
15 about to go into some questions about the confidential  
16 information, Judge, and we just wanted to alert you to  
17 that.

18 JUDGE WALSTON: Okay. Is there anyone  
19 here -- maybe we need to go over the protective  
20 order -- that doesn't fit within the criteria? I  
21 believe everyone here is either a party or a named  
22 expert.

23 MR. FORSBERG: I may have a couple of  
24 individuals here who are not --

25 JUDGE WALSTON: That are not parties?

1 MR. FORSBERG: -- who may not be  
2 parties.

3 MR. WILLIAMS: We have one who is not  
4 one of our testifying experts.

5 JUDGE WALSTON: You have one what?

6 MR. WILLIAMS: We have one party here  
7 who is not one of our testifying experts.

8 MR. RILEY: If they're part of TCEQ --

9 MR. WILLIAMS: Okay.

10 JUDGE WALSTON: Are they part of the  
11 Commission?

12 MR. WILLIAMS: Yes.

13 JUDGE WALSTON: Okay.

14 MR. FORSBERG: If we could just be  
15 advised when that period of discussion of that topic  
16 is over so that we can invite her back?

17 MR. RILEY: Of course.

18 MR. FORSBERG: Thank you.

19 JUDGE WALSTON: Hang on just a second.

20 Why don't we go off the record.

21 (Discussion off the record)

22 JUDGE WALSTON: Okay. Back on the  
23 record, and let the record reflect that all persons  
24 who are not authorized by the protective order to be  
25 in attendance have been excluded from the room.

1 And, Mr. Riley, you'll let us know when  
2 you're moving out of that topic and into something  
3 else?

4 MR. RILEY: Yes, sir.

5 (The following Pages 943 through 968 are  
6 CONFIDENTIAL and have been separately bound.)  
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<p style="text-align: right;">Page 969</p> <p>1 JUDGE WALSTON: Then we'll go ahead and  2 break for lunch. It's noon now, so we'll resume in  3 one hour at one o'clock.  4 (Recess: 11:58 a.m. to 1:02 p.m.)  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25</p>	<p style="text-align: right;">Page 971</p> <p>1 refer to the numbers that you've used as the location  2 on your Exhibit No. 74?  3 MR. RILEY: Yes, Your Honor.  4 JUDGE EGAN: Thank you.  5 Q (By Mr. Riley) Give me just a second,  6 Dr. Collier, to pull that out, and you a second and  7 everyone else to get oriented.  8 Within your materials that you have with  9 you, are you able to elaborate further on some of the  10 back-up information that you relied upon in drawing  11 the various lines on this map?  12 A Yes.  13 Q Okay. Let's start -- let me first get my key  14 so we can follow along. We have labeled one segment  15 that you've drawn on Exhibit 1P, a line that we  16 have -- or given the number 14A. Can you find the  17 source material for the line you drew as a fault that  18 we've labeled 14A?  19 A That's in Exhibit M, the second page, which  20 is first main Conroe -- first main Conroe sand map.  21 Q And within that exhibit and with respect to  22 that line, can you look at your source material and  23 determine whether indeed it depicts a fault or a water  24 contact?  25 A It's hard to tell looking at the map. I</p>
<p style="text-align: right;">Page 970</p> <p>1 AFTERNOON SESSION  2 MONDAY, DECEMBER 17, 2007  3 (1:02 p.m.)  4 JUDGE EGAN: Let's go back on the  5 record. It's about three minutes after 1:00 on  6 December 17th, 2007.  7 Dr. Collier, you're still under oath.  8 And, Mr. Riley, you're in the process of  9 crossing, so please continue.  10 PRESENTATION ON BEHALF OF  11 THE ALIGNED PROTESTANTS  12 (Continued)  13 HUGHBERT A. COLLIER,  14 having been previously duly sworn, testified as  15 follows:  16 CROSS-EXAMINATION (Cont'd)  17 BY MR. RILEY:  18 Q Good afternoon, Dr. Collier.  19 A Good afternoon.  20 Q I'd like to start this afternoon by again  21 referring back to your Exhibit 1P and discussing some  22 of the light blue colored faults as you describe them  23 in your prefiled testimony around the proposed TexCom  24 facility.  25 JUDGE EGAN: Could you, where possible,</p>	<p style="text-align: right;">Page 972</p> <p>1 originally identified it as a fault. It could  2 possibly be a water contact on here.  3 JUDGE EGAN: It could be a what?  4 WITNESS COLLIER: A water contact.  5 Q (By Mr. Riley) What is a water contact,  6 Doctor?  7 A Well, what they're showing is if you look at  8 the color coding -- actually they're not showing it as  9 a water contact. Their light green colors are  10 their -- let me pull it up. The darker green color  11 here is what they labeled a gas cap shrinkage. And  12 there's a lighter green color and that's remaining  13 original oil zone. And then you see -- if you come  14 south of it towards the southeast since it's kind of  15 oriented towards that way, that's remaining original  16 gas cap.  17 So what there it could be possibly  18 showing is a contact between the original -- well,  19 they're showing it all as being gas cap and they're  20 looking at the amount of shrinkage. And they --  21 they're looking at the contact between the gas cap and  22 the oil. So it could be a gas/oil contact there.  23 Q Okay. But you've depicted it on your Exhibit  24 1P as a fault, did you not?  25 A Yes.</p>

1 Q And that's incorrect, is it not?  
 2 A Yes, it could be.  
 3 Q No -- is it or is it not?  
 4 A Well, the map is so small and their  
 5 contact -- it probably -- I'll say it's incorrect.  
 6 Q All right. By the way, Doctor, back-up  
 7 information for these maps that you've included is  
 8 available at the Texas Railroad Commission. Is that  
 9 correct?  
 10 A Correct.  
 11 Q Have you looked at any data, raw data, that  
 12 went into compiling of the maps that Exxon -- that you  
 13 relied upon from Exxon?  
 14 A I did review the information.  
 15 Q You did review the information. When did you  
 16 do that?  
 17 A When we collected all of the records.  
 18 Q Okay. Now, Doctor, did you personally go to  
 19 the Railroad Commission and look at the back-up  
 20 information that supports the various maps that you've  
 21 introduced with your testimony?  
 22 A I personally went to the Railroad Commission  
 23 and pulled the information with the files.  
 24 Q So when I asked you this question in your  
 25 deposition -- what date was that, then?

1 A It was a couple of months ago we went -- a  
 2 month or two. I don't remember the exact date.  
 3 Q Certainly prior to when I took your  
 4 deposition in Conroe in this matter. Is that correct?  
 5 A Oh, yes.  
 6 Q So when I asked you the question of whether  
 7 you looked at any of the data that supported the Exxon  
 8 maps and you indicated you had not, was that correct?  
 9 A I looked at the data in the files. A lot of  
 10 the data on which this map is based upon is not in the  
 11 files.  
 12 Q Well, I'm going to find the deposition  
 13 question and I'll read it to you and see if your  
 14 answer was truthful at that time. Just give me a  
 15 minute. We'll come back to this.  
 16 A All right.  
 17 Q Moving on though, Doctor, with respect to the  
 18 segment that we've labeled 14B -- you find that on  
 19 your Exhibit 1P?  
 20 A Yes.  
 21 Q And what is the offset for exhibit -- excuse  
 22 me, for Segment 14 -- I'll say 14B -- yes, 14B?  
 23 A It's -- again, it's very hard to read the  
 24 contour lines, but it's -- those are 50-foot contours.  
 25 It's less than 50 feet.

1 Q And in what exhibit are you referring to it  
 2 being less than 50 feet?  
 3 A The same one we've been talking about.  
 4 Q Is that Humble Exhibit 8?  
 5 A Yes.  
 6 Q Okay. Could you look at Humble Exhibit 9?  
 7 A All right.  
 8 Q And in Humble Exhibit 9 would you agree that  
 9 it's somewhere between 10 and 40 feet -- I'm sorry, 15  
 10 and 40 feet. I apologize.  
 11 A I'll accept that. Again I can't read the  
 12 numbers on the map.  
 13 Q Where is Humble -- where is the horizon that  
 14 is depicted in Humble Exhibit 8 versus the horizon  
 15 that's depicted in Humble Exhibit 9?  
 16 A The Humble Exhibit 8 sand overlies the Humble  
 17 Exhibit 9, which is the second main Conroe sand QA  
 18 member.  
 19 Q So we are moving deeper in the upper  
 20 Cockfield. Is that correct?  
 21 A Correct.  
 22 Q We're not into the middle Cockfield. We're  
 23 moving within the sands in the upper Cockfield,  
 24 correct?  
 25 A Correct.

1 Q So as we go from Humble Exhibit 8 down to  
 2 Humble Exhibit 9 -- and by down I mean deeper into the  
 3 earth, correct?  
 4 A Correct.  
 5 Q And would that also be true for Humble  
 6 Exhibit 10?  
 7 A Yes.  
 8 Q We're still going deeper in the upper  
 9 Cockfield -- not into the middle, but still in the  
 10 upper Cockfield, correct?  
 11 A Yes.  
 12 Q And the throw -- or, excuse me, the offset in  
 13 Humble Exhibit 10 for that same indication on the  
 14 Humble map is approximately 40 feet. Is that correct?  
 15 A I'll accept that.  
 16 Q I'm sorry, I mischaracterized it. Somewhere  
 17 between 10 and 40 feet?  
 18 A I'll accept that.  
 19 Q And finally on Humble Exhibit 11, again going  
 20 deeper, correct, in the upper Cockfield --  
 21 A Yes.  
 22 Q And it shows to be somewhere on the order of  
 23 40 feet offset. Is that correct?  
 24 A I'll accept that.  
 25 Q And then Humble Exhibit 12, which is, again,

1 deeper into the upper Cockfield, above the middle  
 2 Cockfield, shows that there's no fault. Would you  
 3 also accept that?  
 4 A You have to be careful how you phrase it.  
 5 Q All right. Well, it doesn't show a fault on  
 6 the depiction, does it?  
 7 A Right. And it shows no data. They had no  
 8 data there.  
 9 Q All right. That's your understanding,  
 10 correct?  
 11 A That's what the map shows.  
 12 Q That's what the map shows. That's your  
 13 understanding, correct?  
 14 A Correct.  
 15 Q Again, we are -- based on our earlier  
 16 discussion from this morning, we are still talking --  
 17 if we look at TexCom Exhibit 72 -- about the horizons  
 18 in the upper Cockfield just below the Jackson shale,  
 19 correct?  
 20 A Correct.  
 21 Q We are not talking about any mapped horizons  
 22 in either the middle Cockfield or the lower Cockfield,  
 23 correct?  
 24 A Correct.  
 25 Q Doctor, do you have an opinion as to why

1 Exxon was particularly interested in mapping the upper  
 2 Cockfield?  
 3 A The upper Cockfield is the zone they're  
 4 producing out of.  
 5 JUDGE EGAN: I'm sorry, you're going to  
 6 need to speak into the mic.  
 7 WITNESS COLLIER: It's the zone they  
 8 were producing out of.  
 9 Q (By Mr. Riley) In fact, in the history of  
 10 the Conroe field, the upper Cockfield is the  
 11 productive zone. Is that correct?  
 12 A Correct.  
 13 Q And there is not production -- or has not  
 14 historically been production from the middle or lower  
 15 Cockfield. Is that also correct?  
 16 A Correct.  
 17 Q Would it indicate to you, Doctor, as an  
 18 expert geologist, that the Jackson shale is an intact  
 19 barrier layer or confining unit by the fact that for  
 20 some 70 years there's been oil and gas production from  
 21 the upper Cockfield?  
 22 A That statement is not entirely true.  
 23 Q All right. If there were fractures or faults  
 24 in the Jackson shale that were transmissive  
 25 vertically, would that not have led to release of the

1 hydrocarbons beneath it?  
 2 A Yes.  
 3 Q So is it again evidence that the Jackson  
 4 shale is a confining unit, that it has secured  
 5 hydrocarbons that have been produced for more than 70  
 6 years?  
 7 A No.  
 8 Q Doctor, the -- I found no fault -- again,  
 9 based on your evaluation of back-up information -- I  
 10 found no line that you've drawn, no fault that you say  
 11 exists, other than the two identified by the applicant  
 12 that showed an offset -- a vertical offset of more  
 13 than 60 feet. Do you disagree with that statement?  
 14 A I'll agree with that.  
 15 Q Earlier today we discussed a Fall-off test.  
 16 Do you remember that discussion?  
 17 A Yes.  
 18 Q And while I don't think you had very detailed  
 19 familiarity with Fall-off tests, are you familiar with  
 20 the term of "radius of investigation"?  
 21 A Yes.  
 22 Q What does that mean?  
 23 A That's the distance out for which the test is  
 24 characterizing the zone that's being tested.  
 25 Q All right. Are you familiar with whether

1 zone -- excuse me, whether a Fall-off test can depict  
 2 boundary conditions?  
 3 A Yes.  
 4 Q And in fact, boundary conditions, Doctor, why  
 5 don't you explain what boundary conditions are?  
 6 A A boundary condition could be a ceiling  
 7 fault. It could be a pinch-out of the unit that's  
 8 being tested. For instance, if it's a sand -- let's  
 9 say you go out a thousand feet and the sand is no  
 10 longer present there, it becomes an impermeable  
 11 barrier. Various types of things you can detect if  
 12 you have a boundary condition -- it could be a fault.  
 13 It could be what geologists call a pinch-out.  
 14 Q It also could be an opening into a more  
 15 transmissive sand, could it not? It simply measures a  
 16 differentiation and pressure at a boundary. Is that  
 17 correct?  
 18 A Correct.  
 19 Q So it is neither -- it doesn't have to be a  
 20 ceiling feature, it could actually be a more  
 21 transmissive sand, correct?  
 22 A Correct.  
 23 Q And are you aware of the radius of  
 24 investigation for the Fall-off test?  
 25 A No.

1 Q If I represented to you that it was 1500 feet  
2 or more and showed no boundary conditions, can you  
3 reach any conclusion?

4 A If it -- if it looked at 1500 feet and showed  
5 no boundary conditions based upon that test, for the  
6 interval that they were testing, you could surmise  
7 there's no boundary condition.

8 Q So you would think though -- well, is the  
9 test valid for consideration in this case?

10 A It would be evidence that you would want to  
11 look at, yes.

12 Q And it would still, whether it's a -- let me  
13 withdraw that question --

14 You relied on earlier in your testimony  
15 saying what you thought the applicant should have  
16 modeled in terms of permeability, correct?

17 A Yes.

18 Q And for that reason you must think that the  
19 Fall-off test was reliable, correct?

20 A Yes.

21 Q And even though it perforated different sands  
22 than the applicant proposes to perforate within the  
23 same injection zone, would you also agree the test is  
24 valid in determining whether there are any boundary  
25 conditions within the radius of investigation?

1 A For the radius investigation for the interval  
2 that was perforated in the test.

3 Q Okay. Well, if the interval that was  
4 perforated was 100 feet or 90 feet, and it was  
5 perforated in the lower Cockfield sand, would you find  
6 it to be helpful in evaluating any boundary conditions  
7 in the lower Cockfield sand for a radius of 1500 feet?

8 A Yes.

9 MR. RILEY: May I have just a minute,  
10 Your Honors?

11 JUDGE EGAN: Yes.

12 Q (By Mr. Riley) Doctor, I'd like to call your  
13 attention to your Exhibit 1Q in the application. If  
14 you would take a moment and pull that out, let's  
15 discuss one of your notations on that exhibit.

16 A I have it out.

17 Q All right, Doctor, there is a notation on the  
18 TC Howell survey that gives an API number. Can you  
19 tell us what an API number is?

20 A It's the American Petroleum Institute, and  
21 it's a unique number assigned to -- at least to modern  
22 days assigned to every well.

23 Q All right. And is it correct over the course  
24 of time, Doctor, the APA -- excuse me -- the API  
25 numbers are relatively recent developments? In other

1 words, most wells don't have API numbers. Is that  
2 correct?

3 A Yes. I don't know if -- many of the old  
4 wells pre-fifties or forties, somewhere in there, they  
5 wouldn't have them.

6 Q All right. And, Doctor, I think this is, to  
7 some extent, a function of mislabeling in the  
8 application of a boring log or a log -- excuse me, I  
9 guess it's an electric log -- of -- that was labeled  
10 in the application C-425, and you've indicated on this  
11 exhibit that the log total depth is 12,494 feet?

12 A Correct.

13 Q And that -- was that because you found it in  
14 the application labeled -- I'm sorry -- labeled C-425?

15 A Correct.

16 Q Could you take a minute and look at that log,  
17 if you have it before you?

18 A I don't have it with me.

19 Q All right. Let me provide you a copy. But  
20 it is in the applicant's exhibits in the well logs  
21 Volume 3 of 15, Page 58 of 58. So it should be right  
22 at the back.

23 Do you have it now in your hand, Doctor?

24 A Yes.

25 MR. RILEY: Does everybody else have it?

1 Q Doctor, if you'd look at the -- first of all,  
2 the applicant labeled the document C-425. Is that  
3 correct?

4 A Correct.

5 Q And that was your reason for identifying with  
6 the map that's depicted in your Exhibit 1Q?

7 A Correct.

8 Q If you look at it a little more closely  
9 perhaps, could you -- do you find where it describes  
10 the location of that well or the well that that log  
11 represents?

12 A Yes.

13 Q And that would be 500 feet from the -- and  
14 it's FNWL, and that stands for from northwest line,  
15 correct?

16 A That's correct.

17 Q And 800 feet from east line, correct?

18 A From the east line of the lease and survey.

19 Q And would you agree with me that that  
20 corresponds on the map to Well No. C-426? If you'll  
21 look at a dry hole up in the TC Howell survey in the  
22 upper left-hand -- excuse me, right-hand portion of  
23 that survey?

24 A Well, it may. It depends on where they put  
25 the northwest line.

1 Q Does the well log --  
 2 THE REPORTER: I'm sorry, I didn't hear  
 3 the end --  
 4 MR. RILEY: I'm sorry, there was  
 5 something --  
 6 WITNESS COLLIER: That was me.  
 7 Q (By Mr. Riley) Does the well log indicate  
 8 that it was a dry hole?  
 9 A The well log does not indicate that it was a  
 10 dry hole.  
 11 Q Okay. And the -- as best you can tell from  
 12 looking at the depiction -- or the description in the  
 13 well log of the well location -- can you -- can you  
 14 identify the well log as relating to C-426?  
 15 A As far as the description? As far as the  
 16 location?  
 17 Q Yes, sir.  
 18 A It's not going to agree exactly, because it  
 19 says it's 500 feet from the northwest line and  
 20 800 feet from the east line.  
 21 Q But it's certainly not Well 425. Can we at  
 22 least agree that far?  
 23 A Yes.  
 24 Q That is the well log that you're relying on  
 25 for the depth that you associated with Well C-425,

1 correct?  
 2 A Yes.  
 3 MR. RILEY: Thank you, Doctor. I have  
 4 no further questions and I pass the witness.  
 5 JUDGE EGAN: Mr. Williams?  
 6 CROSS-EXAMINATION  
 7 BY MR. WILLIAMS:  
 8 Q Good afternoon, Dr. Collier. My name is John  
 9 Williams. I represent the Executive Director.  
 10 JUDGE EGAN: Microphone.  
 11 MR. WILLIAMS: I'm sorry. Thank you.  
 12 A Good afternoon.  
 13 Q Can you hear me now?  
 14 A Yes.  
 15 JUDGE WALSTON: Yes.  
 16 Q Dr. Collier, does every fault visible at the  
 17 surface extend 6,000 feet below the surface?  
 18 A No.  
 19 Q Do some faults that are visible at the  
 20 surface extend that deep?  
 21 A Yes.  
 22 Q Does every fault that exists at 6,000 feet  
 23 below the surface extend upward to the surface?  
 24 A No.  
 25 Q Do some?

1 A Yes.  
 2 Q Is it your position that every fault within  
 3 the area of review that you mapped in your Exhibit 1P,  
 4 does every one of those faults extend upward to the  
 5 surface?  
 6 A No.  
 7 Q What stops them?  
 8 A Some faults will die out structurally and --  
 9 they'll just -- they just die out. At the end they  
 10 terminate.  
 11 Q Okay. Is it your testimony in your prefiled  
 12 that all of the faults that you've depicted in Exhibit  
 13 1P are transmissive laterally across the faults?  
 14 A No.  
 15 Q Can you be more specific which ones are and  
 16 which ones aren't?  
 17 A No.  
 18 Q Are all the faults that you depicted in  
 19 Exhibit 1P transmissive vertically upward?  
 20 A No.  
 21 Q Do you know which ones are?  
 22 A No.  
 23 Q You mentioned in your prefiled -- on Page 11  
 24 of 41 of your prefiled testimony, you mention on Line  
 25 3 about liquids injected are connate. Can you please

1 explain what connate waters are?  
 2 A Connate water is -- a lot of logging people  
 3 use it to refer to the naturally-occurring fluids that  
 4 are in a formation.  
 5 Q Thank you.  
 6 MR. RILEY: What page was that on?  
 7 JUDGE EGAN: Page 11.  
 8 MR. WILLIAMS: Page 11 of his prefiled.  
 9 JUDGE EGAN: Line 3.  
 10 MR. WILLIAMS: Line 3.  
 11 Q (By Mr. Williams) On your Exhibit 1C, the  
 12 photographs of faults -- the one, two, three, fourth  
 13 page -- Mr. Riley was asking you about the Big Barn  
 14 East Fault. Can you tell me what in that photograph  
 15 tells you that there is a fault there?  
 16 A You notice from where the vehicle is parked  
 17 coming back out towards us, you notice there's a  
 18 section of the road that's repaved.  
 19 Q Okay. The lighter part of the photograph?  
 20 A Well, it's the dark part you see --  
 21 Q Okay. The dark part.  
 22 A The dark part. That is repaved. This is a  
 23 fault -- and I misspoke earlier. It's Carl Norman,  
 24 N-o-r-m-a-n, not Newman.  
 25 Q Right.

1 A This is a fault that Carl Norman has been  
2 monitoring for over 20 years. And what you see here  
3 is that periodically you get enough of a bump in the  
4 road that they have to go in there and smooth it out  
5 and repave part of it. And that's what they've done  
6 here.

7 Q Okay. Some of these other faults -- other  
8 photographs showing cracks in the pavement, how do you  
9 distinguish cracks in the pavement from a fault from  
10 cracks in the pavement because of some failure of the  
11 subbase in the road?

12 A That's a good question. You want to, one,  
13 look and see if there's any evidence for anything  
14 subbase in the -- along that part of the road. Is  
15 there a culvert? Is there something else extending  
16 out on either side, maybe a previous road?

17 If you don't find any kind of evidence  
18 for something that could have collapsed, you look for  
19 subtle or not-so-subtle differences in elevation.  
20 It's basically a bump in the road. You go from one  
21 side of these cracks to another. And when you feel  
22 that bump and you get out and look at it, and you see  
23 that there is an offset, that is evidence to support  
24 that that is -- there's strong evidence that could be  
25 a fault. Certainly not every crack in the road is a

1 fault. And we that -- there were some of these roads  
2 that had a lot of cracks going straight down the road  
3 for a long distance. And we got on -- the further we  
4 looked we saw that was just poor road construction and  
5 poor subbase.

6 There's a linearity to it that also  
7 sometimes you can -- you can see extending very subtly  
8 off on either side. You may see this continue off  
9 across the road and a subtle change in elevation.

10 Q Okay. On your Exhibit 1O, the map of these  
11 surface faults, to the left of the four proposed  
12 TexCom wells you've got a long curving yellow line,  
13 and you've got the -- the name is "Lineament." Could  
14 you explain what that is and how you discovered that?

15 A Yes. Underlying most of that yellow line,  
16 you can see -- this is based upon -- I think this is a  
17 LIDAR image and you can see the subtle indication  
18 underneath that line for much of the length of a  
19 little drainage. And you can see how the drainage  
20 kind of lines up in a slightly curved area.

21 This was one that was pointed out to me  
22 by Bob Ringholz with Fugro Geophysical. They had a  
23 retired geologist who was -- who is a contemporary of  
24 Carl Norman, and that's what he specializes in. So he  
25 was not willing to identify this as a fault, but it's

1 a linear -- to curve a linear feature that many times  
2 those prove out to be faults. But you don't have  
3 enough evidence here, so you just call it a lineament,  
4 which means it's really an abnormal or -- you don't  
5 normally see those types of straight to slightly  
6 curved features on the surface.

7 Q Okay. And on your Map 1O you have identified  
8 a feature known as a sinkhole down toward the  
9 southeast perimeter of the two-and-a-half mile radius.  
10 There's a blue letter "I" marking the spot. Is that  
11 the sinkhole you have pictures of in Exhibit 1C?

12 A Yes.

13 Q I have to admit I'm having trouble seeing a  
14 sinkhole in these pictures. Could you help me  
15 identify it?

16 A Notice sinkhole is in quotation marks.

17 Q Okay.

18 A I didn't know what else to call it. The  
19 feature is so large that it is -- it is very hard to  
20 get it within any pictures.

21 Q Okay.

22 A So it's -- notice there's a chain-link fence  
23 around it. It's a large elliptical-shaped body. Then  
24 the trees -- really kind of the edge of it starts with  
25 that brush line or tree line inside the fence.

1 Q Okay.

2 A And when you read the articles about the  
3 early development of the field, they lost a drilling  
4 rig on one location. They lost a christmas tree on  
5 another. They had a collapsed feature that resulted  
6 in a feature 200 feet in diameter and about -- they  
7 estimated to be 800 feet deep. So they had a number  
8 of blowouts. That's why took the pictures and that's  
9 why it's in quotation marks.

10 Q Okay.

11 A It's not a classical geological sinkhole.

12 Q Right. Could you explain what a christmas  
13 tree is in the oil business?

14 A A christmas tree is the structure that sits  
15 on top, and it's the -- the valves, the piping, that  
16 controls the access to the well and by which the gas  
17 flows out. It kind of looks like a -- I guess a  
18 roughneck's christmas tree.

19 Q It's not like in a building construction  
20 where they put the juniper on top of the building when  
21 they finish the --

22 A No, no.

23 Q No? Okay. In a couple of places in your  
24 prefiled -- and I'll direct you to Page 23 of your  
25 prefiled testimony --

1 A (Witness complies)  
 2 Q -- on Lines 11 and 12, you say, "This also  
 3 means that the application is administratively  
 4 incomplete."  
 5 A Yes.  
 6 Q Do you see that?  
 7 A Yes.  
 8 Q Have you ever worked for or been an employee  
 9 of the TCEQ or any of its predecessors?  
 10 A No.  
 11 Q I remember you saying that you've worked on  
 12 Class II well applications. Have you been involved  
 13 with any applications before the TCEQ or its  
 14 predecessors?  
 15 A No.  
 16 Q In your experience with Class IIs before the  
 17 Railroad Commission, do you get notices of deficiency  
 18 on those applications?  
 19 A I never received any.  
 20 Q Okay. But you're familiar with the NOD  
 21 process --  
 22 A Yes.  
 23 Q -- in general?  
 24 Do you have a working idea of what  
 25 things, either at the Railroad Commission or TCEQ,

1 that staff look for in their administrative review of  
 2 an application?  
 3 A Yes.  
 4 Q And could you please give us an idea of what  
 5 those things are?  
 6 A Well, in the context of this they're looking  
 7 for all of the wells that's within the two-and-a-half  
 8 mile area of review. And the term may be incorrect  
 9 there "inadministratively" incomplete. Certainly  
 10 there are a number of -- there are approximately 100  
 11 more water wells within the two-and-a-half mile area  
 12 of review than what the applicant identified.  
 13 And so I will admit that the term  
 14 "administratively incomplete" may be incorrect, but  
 15 the technical part of what they submitted is certainly  
 16 incorrect, for which TCEQ, you know, may or may not  
 17 have had any knowledge of that. All they could go on  
 18 was the map that was provided, and that map was taking  
 19 the Water Development Board groundwater data base with  
 20 wells that have state ID numbers, and that's the only  
 21 base that they utilized to prepare that map.  
 22 Q Okay. So are you willing to admit then that  
 23 this -- instead of being administratively incomplete,  
 24 this application could have been technically  
 25 incomplete with this information?

1 A Yes.  
 2 MR. WILLIAMS: I'll accept those answers  
 3 and pass the witness, Your Honor.  
 4 JUDGE EGAN: All right. Any further --  
 5 any further redirect, Mr. Walker?  
 6 MR. WALKER: Yes, ma'am. Just a few  
 7 questions, if I may.  
 8 REDIRECT EXAMINATION  
 9 BY MR. WALKER:  
 10 Q Dr. Collier, you were asked about the Big  
 11 Barn East Fault. Do you recall that line of  
 12 questioning?  
 13 A Yes.  
 14 Q How close does the Big Barn East Fault get to  
 15 the area of review based upon your observation and  
 16 research?  
 17 A It is right on the edge, but within the  
 18 two-and-a-half mile area of review.  
 19 Q All right. Is there a particular reason or  
 20 rationale for not classifying a fault as major or  
 21 minor if in fact one doesn't so classify?  
 22 A Yes. Again, as I mentioned this morning, it  
 23 would depend upon for what purpose you were  
 24 identifying faults. And in the context of the  
 25 application, the applicant is charged with identifying

1 the presence of faults and fractures, and then having  
 2 identified them, to look at every one and decide  
 3 whether or not they're transmissive. So it makes no  
 4 difference if it's a major or minor fault. Major and  
 5 minor faults can both be transmissive. They can be  
 6 conduits for the upward or the downward movement of  
 7 fluid. So in that regard it doesn't make any  
 8 difference if it's major or minor.  
 9 Q Is it possible for fluid to migrate through  
 10 or along a fault that has a four- or five-foot throw?  
 11 A Yes.  
 12 Q I think there has been some discussion  
 13 earlier, Dr. Collier, of a lack of correlation --  
 14 MR. RILEY: Mr. Walker, could I ask you  
 15 to speak into the microphone? I'm having trouble  
 16 hearing you.  
 17 MR. WALKER: I'm sorry.  
 18 Q (By Mr. Walker) I think there was some  
 19 previous testimony about the lack of correlation  
 20 between the map fault lines. Is there perhaps some  
 21 explanation you can give for that fact I guess?  
 22 A Yes, if we look at a couple of consequences,  
 23 I was questioned earlier regarding my exhibit -- let  
 24 me make sure I have the right one -- Exhibit M, which  
 25 is from the 1972 Railroad Commission hearing. And

<p style="text-align: right;">Page 997</p> <p>1 your question is, is there a reason for lack of  2 correlation from one map to another, from one strata  3 to another. And we walked through Humble Exhibit 8,  4 9, 10. And then on 11, most of the faults right up  5 close to our injection wells, those faults disappear.  6 And the reason they disappear, there's no well  7 control. The wells didn't go deep enough.  8 And so if the wells don't go deep  9 enough, you have no data to do any mapping. That's  10 why you notice that there's no contour lines over  11 virtually all of the TC Howell survey on Humble  12 Exhibit No. 11. There aren't any at all on Humble  13 Exhibit No. 12. And you see the same thing on Humble  14 Exhibit 13 and 14.  15 And what you see is the area that  16 they're mapping shrinks as you go from 8, 9, 10, 11,  17 12. And the area that they're mapping shrinks because  18 they don't have any well control. They don't have any  19 wells that went deep enough.  20 So are there faults on the map? No.  21 Are there faults that exist there? The map doesn't  22 tell you one way or the other because they had no data  23 for that interval. And that's the same rationale for  24 the Geomap maps. They didn't map all the faults. And  25 for many of these others you have quote -- in</p>	<p style="text-align: right;">Page 999</p> <p>1 MR. RILEY: My legal basis is this  2 witness is not a legal expert and cannot interpret the  3 TCEQ rules, and has never worked in this area, which  4 would be another reason for objecting.  5 JUDGE EGAN: Other than -- you want to  6 lay a better predicate?  7 MR. WALKER: Thank you, Your Honor.  8 Q (By Mr. Walker) Dr. Collier, is there a -- is  9 there a qualification for the kinds of faults that are  10 to be set forth in the application?  11 A None.  12 Q Anything, as far as you know, that only  13 major, substantial faults are to be designated?  14 A No qualifications in regard to that.  15 Q In your experience as a hydrogeologist,  16 Dr. Collier, why is it important to locate all of the  17 faults that can be located, within the area of review?  18 MR. RILEY: Objection. Same objection.  19 He's never done an application for any type of well --  20 disposal well, Class II or Class I -- and this is  21 obviously referring to an area of review being a  22 regulatory requirement, not some generic term;  23 therefore, I don't think he's qualified to answer that  24 question.  25 JUDGE EGAN: Overruled.</p>
<p style="text-align: right;">Page 998</p> <p>1 quotation marks discrepancies from one map to another  2 depending upon the number of logs they had available  3 the wells they used. And that's why these  4 differences.  5 Q Thank you, Dr. Collier. Let me ask you if  6 you recall the testimony concerning TexCom Exhibit 74  7 and a reference to a line on there that was designated  8 14A. I believe you testified that that reference or  9 that designation was incorrect. Is that right?  10 A Yes.  11 Q If you subtract that particular designation,  12 how many faults did you discover in your research  13 within the area of review?  14 A That makes 23.  15 Q Let me ask you this: How many faults did the  16 applicant designate in the application?  17 A Two.  18 Q Dr. Collier, during your review of the TexCom  19 application, did you have an occasion to review Rule  20 331.121 of the Texas Administrative Code?  21 A Yes.  22 Q What is the requirement set forth in that  23 particular rule with respect to delineation of faults?  24 MR. RILEY: Objection.  25 JUDGE EGAN: Your legal basis?</p>	<p style="text-align: right;">Page 1000</p> <p>1 Q (By Mr. Walker) You can answer the question,  2 Dr. Collier.  3 A Any time you do any kind of study of the  4 subsurface and you want to determine if you can have  5 vertical migration from one bed to another, not only  6 do you have to look at those beds and the properties  7 of those horizons or beds -- and in this case we'll  8 take the Jackson, which is a thousand feet of mudstone  9 and shale, on its own, if there was nothing else, that  10 would be a suitable confining unit and a barrier to  11 vertical migration.  12 But if you have faults in the area -- or  13 if you have artificial penetrations, but we're talking  14 about faults here -- if you have faults in the area  15 below it and above it and in it, then that's a big red  16 flag, and you have to look, as is required in the  17 application, to look at all the faults and identify  18 them because they can potentially be transmissive.  19 Q How many faults, Dr. Collier, did you -- or  20 have you located that extend down into the upper  21 Cockfield area?  22 A 19 of these.  23 Q Does that involve having excluded the one  24 that was referenced as 14A on Exhibit 74?  25 A Yes.</p>



<p style="text-align: right;">Page 1001</p> <p>1 Q Do you know, Dr. Collier, if all of those  2 faults, those 19, extending down into the upper  3 Cockfield, are they transmissive?  4 A No, I do not know if all of them are.  5 Q Do you know if none of them are transmissive?  6 A I do know that that is not correct. Some of  7 them are transmissive.  8 Q All right. With respect to your research in  9 this particular case -- and let me direct your  10 attention to the 1975 paper, the Whitson, Davies and  11 Burns paper -- did you find any information that  12 reflected fluid migration through any mudstone in the  13 area of review?  14 A Yes, that's one of the -- that paper is  15 Exhibit I. Exxon was having trouble in the field  16 because they were losing their gap of gas from these  17 main Conroe sands, and the gas was migrating upward  18 into the upper Cockfield. That's that pipe log that  19 we looked at earlier.  20 And if you turn to I and turn to the  21 second page, which is Page 814, and look at Figure 2,  22 that's the type electric log. And so you see this box  23 around first main Conroe sand and 2 through 6 main  24 Conroe. Those producing intervals were losing the gas  25 up into the upper Cockfield.</p>	<p style="text-align: right;">Page 1003</p> <p>1 the cement had deteriorated in some of the wells. So  2 in the 1975 paper they have a mathematical formula for  3 modeling fluid flow behind pipe, behind casings, out  4 in the angular space. They had to include that in  5 their reservoir modeling.  6 The second conduit that they identified,  7 going back to this Exxon Exhibit No. 31, the  8 next-to-last page, is migration across faults due to  9 juxtaposition of sands. And then the third one on the  10 far right is migration of fault plain to shallow  11 sands.  12 Q Dr. Collier, let me ask you, in your  13 professional opinion, hydrogeologically how would you  14 categorize the subsurface geology, given everything  15 that you've talked about today, of this area of  16 review -- simple, complex -- how would you categorize  17 it?  18 A It's complex. The faulting here makes it  19 complex. There are a number of faults scattered  20 throughout the Conroe field. And there are a number  21 of faults scattered throughout the area of review.  22 Most of them are in the subsurface, but there is a  23 surface expression of the lineament and one fault even  24 on the surface. There is -- it's very complex because  25 there's faulting at 500 feet; there's faulting within</p>
<p style="text-align: right;">Page 1002</p> <p>1 So Exxon started doing a study, and this  2 study is referenced in some of the other Railroad  3 Commission hearings. And what they found was they  4 were losing their gas because of a pressure  5 differential and they developed the field. And the  6 gas was in part migrating up fault lanes. So they  7 even drew a diagram of this that -- they didn't put it  8 in the 1975, but they put it in their Railroad  9 Commission hearing that we've been referring to here  10 earlier today, the 1979 hearing.  11 If you turn to the last page -- that's  12 J. And if you turn to the last page of J -- the  13 next-to-the-last page. The last page is this plastic  14 with a map inserted. And turn to the page before  15 that, and you can see Exxon's work in '72 and  16 everything was put together in the '75 paper.  17 And they show you the conduits -- the  18 three conduits that they said existed within the  19 Cockfield. One was communication through wellbores  20 and behind pipe.  21 JUDGE EGAN: And what?  22 WITNESS COLLIER: Through the wellbores  23 and behind pipe, behind the casing.  24 JUDGE EGAN: Okay.  25 A And in the 1975 paper they talk about that</p>	<p style="text-align: right;">Page 1004</p> <p>1 the lower part of the Jackson confining unit that was  2 mapped back in the 1950s in a field trip guidebook;  3 and then there's faulting in various -- in all these  4 zones within the upper Cockfield.  5 And then when you skip to the Geomap and  6 look at the base of the Yegua or the lower part, the  7 base of the Cockfield, they catch -- even in their  8 very simplified map in the sense they didn't try to  9 look at every well -- even just selecting just a few  10 well logs and mapping they caught faulting below at  11 the base of the Yegua as well. So it's very complex  12 structurally.  13 MR. WALKER: Thank you, Dr. Collier.  14 I'll pass the witness .  15 JUDGE EGAN: Lone Star?  16 MR. GERSHON: No questions.  17 JUDGE EGAN: Mr. Forsberg?  18 MR. FORSBERG: Nothing, Your Honor.  19 JUDGE EGAN: Ms. Collins?  20 MS. COLLINS: No questions. Thank you.  21 JUDGE EGAN: Mr. Riley?  22 MR. RILEY: Yes, I have several.  23 JUDGE EGAN: Be reminded that this is  24 recross.  25 MR. RILEY: Yes, ma'am.</p>

## CROSS-EXAMINATION

1 BY MR. RILEY:

2 Q Doctor, I thought I understood you to say  
3 that there isn't adequate data in the Exxon materials  
4 to determine any faults in the lower Cockfield.

5 A The faults that are determined in the lower  
6 Cockfield are not in the Exxon data. I never said  
7 that.

8 Q I'm asking you, when you were going through  
9 this just a moment ago with Mr. Walker, and you were  
10 explaining why you think there is faulting that must  
11 be considered in this application, I'm asking for your  
12 evidence of any faults in the lower Cockfield?

13 A That is the Geomap structure map on Horizon  
14 B.

15 Q So I should look simply at the Geomap  
16 structure map on Horizon B for all of your evidence of  
17 faulting in the lower Cockfield?

18 A Well, that needs to be -- no, I would not  
19 just look at that. That is the only map that's  
20 present mapped on that horizon.

21 Q Okay. Let me try one more time. Tell me all  
22 of your evidence and indicate to me where your faults  
23 are found on Exxon materials or otherwise that are  
24 mapped in the horizon that we've been discussing, the  
25

1 it.

2 Q Or none of them could. Is that also true,  
3 Doctor?

4 A No, because you see that with the faults that  
5 you have -- that the applicant identified.

6 Q So you're certain of two, the ones that the  
7 applicant has in its application, correct?

8 A Yes.

9 Q So the other faults you have no evidence,  
10 zero, none at all, that they extend into the lower  
11 Cockfield, correct?

12 A There are not maps constructed on that.

13 Q So you have no evidence, Doctor, that those  
14 faults that you've depicted extend in the lower  
15 Cockfield, correct?

16 A Correct.

17 Q You explained to Mr. Walker just a few  
18 minutes ago that you are able to determine which of  
19 those faults are transmissive. Is that correct?

20 A No, I did not say that.

21 Q You said that you knew that some of those  
22 faults were transmissive, correct?

23 A Yes.

24 Q How do you know that if you're not able to  
25 tell us which faults are transmissive?

1 lower Cockfield.

2 A The Exxon did not map the lower Cockfield.

3 Q Is your answer then, Doctor, that you have no  
4 evidence of any faults in the lower Cockfield?

5 A I have no evidence of any maps constructed on  
6 the lower Cockfield.

7 Q Okay. What is all your evidence of all the  
8 faults in the lower Cockfield?

9 A The faults that are found in the upper  
10 Cockfield, there is good geological -- a valid  
11 geological conclusion is that some -- not many or all  
12 of these faults -- would extend even into the lower  
13 Cockfield.

14 Q Well, which ones, Doctor? Since you have  
15 valid, geological conclusions and good science behind  
16 your opinion, I'd like for you to be specific as to  
17 which faults extend into the lower Cockfield.

18 A Any or all of them are capable of extending  
19 into --

20 Q That's not my question, Doctor. Based on --  
21 in your opinion, in all the data you've reviewed and  
22 all the time you've spent on this application, I would  
23 like you to tell me which of these faults extend into  
24 the lower Cockfield.

25 A As I said, any or all of them can extend into

1 A Because Exxon in their studies show that  
2 certain faults within the field are transmissive.

3 Q Okay. Which faults did Exxon show are  
4 transmissive?

5 A They do not identify which particular faults.

6 Q Well, that's your conclusion, that Exxon did  
7 not identify where it was losing its gas cap and which  
8 wells were involved?

9 A They identified throughout the whole field.  
10 They did not -- they did not do a compilation of which  
11 faults were transmissive and which were not.

12 Q My question is different, Doctor. Were they  
13 discussing certain wells in which they were losing  
14 their gas cap?

15 A They were discussing the whole field.

16 Q They were discussing the whole field. They  
17 did not explain any further or detail in any greater  
18 detail where they were losing production because of  
19 the loss of the gas cap?

20 A Not that I remember.

21 Q You said that Exxon explained that it had  
22 three reasons -- I'm sorry, you said that Exxon was  
23 concerned that it was losing its gas cap, correct?

24 A Correct.

25 Q And can you tell me, Doctor, the difference,

<p style="text-align: right;">Page 1009</p> <p>1 if any, between transmissivity of gas and fluid in 2 substrata? 3 A Gas will be more transmissive than a liquid. 4 Q Okay. So it is possible that gas could 5 transmit through these faults and liquid would not, 6 correct? 7 A Correct. 8 Q So the indication of gas transmission in a 9 fault is not necessarily indication of fluid 10 transmission, correct? 11 A Well, gas is a fluid. 12 Q You understand what I mean, correct? 13 A Correct. 14 Q So gas transmission as opposed to oil or 15 water would not indicate that oil or water could 16 transmit across that same fault, correct? 17 A It is -- you could have cases where that 18 could be the case, but it is an indication that the 19 fault is transmissive. 20 Q Did you find anywhere in the -- well, 21 transmissive, but again transmissive must be qualified 22 in terms of what is transmitting across the fault, 23 correct? 24 A Correct. 25 Q So back to my question: If we're talking</p>	<p style="text-align: right;">Page 1011</p> <p>1 within the Cockfield, correct? 2 A Correct. 3 Q So there was no indication even of 4 transmission of gas outside of the Cockfield formation 5 through the Jackson by faults, correct? 6 A Not in the Exxon data. 7 Q Is there some other data where you found 8 evidence of transmission through faults into upper 9 stratum -- 10 A Yes. 11 Q And what data is that? 12 A If you look at the 1936 AAPG article on the 13 field -- this is Exhibit No. G, the fault map the 14 application is based on -- and turn to Page -- if you 15 turn to the second page of 737 at the bottom, the 16 history of the field, "The site of the Conroe field, 17 after gas seeps had been found on the Rhodes farm ... 18 had attracted the attention of a local group of men. 19 The field was --" 20 Q I'm sorry, I'm not hearing. You're reading 21 into the book and I'm trying to hear what you're 22 saying. 23 A "The site of the Conroe field, after gas 24 seeps had been found on the Rhodes farm on the WS 25 Rhodes survey," the field was first flagged because of</p>
<p style="text-align: right;">Page 1010</p> <p>1 about water, there is no evidence in the Exxon 2 materials that any of the faults described by Exxon 3 that were causing a loss of its gas cap are 4 transmissive of water, correct? 5 A Correct. 6 Q Nor is there any indication that those faults 7 are transmissive of oil. Is that also correct? 8 A Correct. 9 Q In fact, Doctor, there's no indication that 10 oil production was lost in the Exxon studies, correct? 11 A (No response) 12 Q Other than through loss of the gas cap, which 13 depressurizes the reservoir, there is no indication 14 that oil was leaking through the Jackson shale into 15 upper zones. Is that correct? 16 A Through faults, correct. 17 Q We'll go to artificial penetrations in a 18 minute. But through faults you found no evidence that 19 any of the faults are transmissive or water or oil, 20 correct? 21 A Correct. 22 Q In fact, I think you said, Doctor, if I'm not 23 mistaken, that the transmission of gas that Exxon was 24 concerned with was transmission within the Cockfield 25 entirely -- not through the Jackson, but entirely</p>	<p style="text-align: right;">Page 1012</p> <p>1 gas seeps on the surface. 2 Q We've discussed gas. I asked about oil, oil 3 and water. 4 A And then if you go further in the report -- 5 there's a reference later in the study that they 6 believe that the conduit for the migration of this is 7 through the faults. 8 Q That was in 1936. Am I understanding you 9 correctly? 10 A Yes. 11 Q Tell me, is there production of oil or gas 12 above the Jackson shale in the Conroe field? 13 A Yes. 14 Q So is it more likely or less likely that any 15 gas seeps and/or any oil production seeping -- or oil 16 coming to the surface is from stratum -- productive 17 oil and gas stratum above the Jackson shale rather 18 than below the Jackson shale? 19 A I would say it's more likely because its 20 sourced deeper. So that is probably what sourced the 21 shallow gas even above the Jackson. And then the 22 additional problem you have in the field is -- is some 23 of the blowouts they had in the past are believed to 24 have charged up some of the shallow sands and -- 25 because they were conduits for migration all the way</p>

<p style="text-align: right;">Page 1013</p> <p>1 up through the Jackson up into the shallower sands or  2 all the way up to the surface such as you have in  3 the --  4 Q I'm talking about faults, Doctor. Are you  5 talking about something different now? I'm talking  6 about faults.  7 A About faults.  8 Q You're referring to artificial penetrations.  9 We'll come to that, I promise.  10 A All right.  11 Q But let's talk about faults.  12 A All right. The APG article references  13 permeable faults as being conduits for bringing gas  14 specifically -- and I don't remember if it references  15 oil and water -- up from the Cockfield up to the  16 surface or in shallow sands above the Jackson.  17 Q How many millions of barrels of oil have been  18 produced from the Conroe field?  19 A Several hundred million. I think it's --  20 maybe over 500.  21 Q And would that indicate to you that there are  22 some good, solid confining layers in the Jackson --  23 excuse me, in the Conroe field?  24 A Yes.  25 Q Now, Doctor, you wanted to talk about</p>	<p style="text-align: right;">Page 1015</p> <p>1 stratum, the potential for a blowout occurs. Is that  2 right?  3 A Yes.  4 Q So prior to drilling into that strata can we  5 fairly conclude that it was under high pressure and  6 confined?  7 A Yes.  8 Q So other than the artificial penetration --  9 and perhaps bad practices in drilling that well and  10 describing that event -- or, I'm sorry, in that  11 event -- that's not indicative of anything other than  12 a solid confining layer, correct.  13 A Well, these are called -- these are leaky  14 faults. They are not solid in the fact that they do  15 leak --  16 Q Are you talking about faults again? Because  17 I was now talking about artificial penetration. I  18 assumed a blowout was associated with someone drilling  19 in an oil field not taking proper precautions and  20 pressure -- and hitting a reservoir under extreme  21 pressure and that material coming to the surface and  22 blowing out the well.  23 A Correct.  24 Q All right. So what does that have to do with  25 faults?</p>
<p style="text-align: right;">Page 1014</p> <p>1 artificial penetration, so let's talk about them.  2 Your discussion of blowouts and other happenings in  3 the oil field, do you have any knowledge of where  4 those events occurred?  5 A There was one that occurred -- it's  6 referenced as occurring on the -- within the area of  7 review in the A-672 J. McHorse survey --  8 Q Please tell me what you're looking at so I  9 can refer to it.  10 A Well, if we look at any of your maps -- we  11 can look at 1P or 1Q. And this is referenced, I  12 believe, in the 1936 AAPG article. The blowout  13 section starts on Page 772 of the article.  14 Q And which tract or survey were you referring  15 to?  16 A It's this one right here (indicating).  17 Q Tell me the name again. I can't see that  18 far.  19 A It's the A-672 J. McHorse -- M-c-H-o-r-s-e.  20 Q Okay. Now tell me if I'm wrong, Doctor, that  21 a blowout, when one is talking about drilling an oil  22 well, is the result of pressure, correct?  23 A Yes, that's one way to get it.  24 Q So when one does not take the proper  25 precaution in drilling into a pressurized underground</p>	<p style="text-align: right;">Page 1016</p> <p>1 A I've lost your train on your question. I  2 guess --  3 Q Okay. We were talking about blowouts and  4 artificial penetrations. Are you back to where we  5 were discussing?  6 A Right.  7 Q All right. And a blowout is indicative of a  8 solid confining layer until penetrated by an  9 artificial penetration, correct?  10 A Correct.  11 Q How deep was the well that you've been  12 discussing as a blowout on survey A-672?  13 A I believe it was completed in the upper  14 Cockfield.  15 Q So that would again indicate that the Jackson  16 shale -- at least in the area of that survey -- was a  17 strong barrier to migration of hydrocarbons, correct?  18 A Correct.  19 Q Doctor, is there a difference between the  20 movement of oil or gas in the subsurface versus water?  21 A Yes.  22 Q Could you explain that?  23 A Well, they have different buoyancies; they  24 have different densities.  25 Q So oil floats to the top. Is that correct?</p>

<p style="text-align: right;">Page 1017</p> <p>1 A Correct.</p> <p>2 Q And one would find the gas on top of the oil,</p> <p>3 correct?</p> <p>4 A Correct.</p> <p>5 Q So, therefore, they are under pressure and</p> <p>6 they move upwards. Is that correct?</p> <p>7 A Correct.</p> <p>8 Q As for gravity, does gravity operate in the</p> <p>9 subsurface?</p> <p>10 A Yes.</p> <p>11 Q And is it fair to say that fluids of</p> <p>12 different density would separate the same way they</p> <p>13 would in -- above the subsurface or on the surface?</p> <p>14 In other words, greater density fluids would go to the</p> <p>15 bottom and higher density fluids -- or, excuse me,</p> <p>16 lower density fluids would come to the top?</p> <p>17 A Yes.</p> <p>18 Q As compared to the brine that is in the lower</p> <p>19 Cockfield, do you have any knowledge of the density of</p> <p>20 the injectate?</p> <p>21 A The injectate -- no.</p> <p>22 Q That is proposed by --</p> <p>23 A No, I don't.</p> <p>24 Q -- TexCom?</p> <p>25 Would you expect it to be different from</p>	<p style="text-align: right;">Page 1019</p> <p>1 flag and a permit should be not be granted. Is that</p> <p>2 correct?</p> <p>3 A I won't agree with all of that.</p> <p>4 Q Well, tell me which portions you agree with.</p> <p>5 A They're a big red flag and they have to be</p> <p>6 examined closely to see if the artificial</p> <p>7 penetrations -- if you have the plugging records -- if</p> <p>8 they have been plugged properly, if they have been</p> <p>9 cased properly. The red flag doesn't mean that you're</p> <p>10 going to not be able to have an injection well in</p> <p>11 their vicinity, but they have to be characterized and</p> <p>12 analyzed, each one of them.</p> <p>13 Q And you gave testimony in a case in Wise</p> <p>14 County where you said there were too many artificial</p> <p>15 penetrations around a proposed Class II injection well</p> <p>16 and, therefore, the permit should be denied. Is that</p> <p>17 correct?</p> <p>18 A No, I would not accept that characterization.</p> <p>19 Q Well, in any event, you testified on behalf</p> <p>20 of intervenors in that matter and were opposed -- that</p> <p>21 were opposed to the issuance of the Class II permit</p> <p>22 application.</p> <p>23 A My testimony in that case was not that there</p> <p>24 were too many, but there were artificial penetrations</p> <p>25 within the area of review for which there was not</p>
<p style="text-align: right;">Page 1018</p> <p>1 the brine?</p> <p>2 A Yes.</p> <p>3 Q In what way?</p> <p>4 A Well, I presume it's not going to be exactly</p> <p>5 the same density. It won't have the same salinity.</p> <p>6 Q Would you expect it to be more dense or less</p> <p>7 dense?</p> <p>8 A I would predict that it would be less dense.</p> <p>9 Q Okay.</p> <p>10 A But again, I think the exact injectate has</p> <p>11 not been specified.</p> <p>12 Q So you don't know, is that --</p> <p>13 A I really don't know.</p> <p>14 Q All right. Let's go to -- let's see here. I</p> <p>15 think you said in redirect examination that artificial</p> <p>16 penetrations are a big red flag or something on that</p> <p>17 order. Do you recall your answer to Mr. Walker's</p> <p>18 question?</p> <p>19 A Yes.</p> <p>20 Q All right. You have testified in other</p> <p>21 matters -- in fact, the only other disposal well</p> <p>22 matter where you've given testimony on the same</p> <p>23 points -- is that correct? -- that artificial</p> <p>24 penetrations or a large number of artificial</p> <p>25 penetrations around an injection well are a big red</p>	<p style="text-align: right;">Page 1020</p> <p>1 sufficient documentation and evidence of proper</p> <p>2 plugging.</p> <p>3 Q Okay. Which is more important, the area of</p> <p>4 review or the cone of influence?</p> <p>5 A They are both important.</p> <p>6 Q Which one would you think would be more</p> <p>7 important for purposes of determining whether any of</p> <p>8 the artificial penetrations are likely to be</p> <p>9 transmissive of any injectate?</p> <p>10 A The cone of influence, if it is modeled</p> <p>11 properly.</p> <p>12 Q And you don't do any modeling, so I can't ask</p> <p>13 you questions about whether it was modeled properly in</p> <p>14 this case, correct?</p> <p>15 A Well, we talked about this morning as far as</p> <p>16 the parameters --</p> <p>17 Q Right, but -- I'm sorry. We also talked</p> <p>18 about you've never run a model, you've never submitted</p> <p>19 an application to TCEQ, and you have no earthly idea</p> <p>20 on whether it was modeled correctly in this matter</p> <p>21 other than you disagree with some of the input</p> <p>22 parameters?</p> <p>23 A I will accept the first half of your</p> <p>24 statement, but the second half you can look at the</p> <p>25 parameters and you can have an earthly idea when you</p>

<p style="text-align: right;">Page 1021</p> <p>1 look at the parameters that were used in the input  2 model. And you don't have to have ever ran a model to  3 know whether or not the input parameters are correct.  4 Q All right. And I understand your position on  5 that. Have you reviewed Mr. Grant's testimony in this  6 matter?  7 A Yes.  8 Q Do you agree with Mr. Grant's conclusions  9 regarding how he modeled the reservoir?  10 A Yes.  11 Q Okay. Again, based on you agree with his  12 input parameters as opposed to the applicant's input  13 parameters?  14 A Yes.  15 Q Tell me the difference between the two models  16 that were run by Mr. Grant and the ones that were run  17 by Mr. Casey.  18 A In the application they're using a 10 square  19 mile area for doing the reservoir modeling. Ten  20 square miles, that's about, you know, a little bit  21 bigger than a three-mile square. And that's too big a  22 block to use when you look, potentially at the nature  23 of faults. If you have faults that are  24 nontransmissive faults, that's basically -- that's not  25 a conservative calculation.</p>	<p style="text-align: right;">Page 1023</p> <p>1 faults in the area, determine which ones are  2 nontransmissive and go ahead and constrain your  3 modeling based upon that.  4 Q And that's what Mr. Grant said he did in his  5 review of the modeling. He ran his own modeling  6 calculation considering the fault that we've been  7 discussing -- I think it's Item No. 30 or Fault No. 30  8 in the spreadsheet -- excuse me, in the exhibit we put  9 together, Exhibit 74, correct?  10 A Correct.  11 Q And Mr. Grant said that he modeled that using  12 a different program as a nontransmissive pressure  13 barrier, correct?  14 A I believe that's right.  15 Q Do you agree with how Mr. Grant modeled the  16 reservoir?  17 A I'll accept his modeling.  18 Q Okay. Is that to say, Doctor, that you agree  19 with Mr. Grant's assessment of the faulting in the  20 area and how he modeled the reservoir?  21 A He did not model as many -- he did not, I  22 think, identify as many faults in the area as we did  23 on our map.  24 Q In fact, he identified one other fault, which  25 was a 50-foot offset fault and that he thought would</p>
<p style="text-align: right;">Page 1022</p> <p>1 Q Do you know the difference between the two  2 models, the one that Mr. Grant used and the one that  3 Mr. Casey used?  4 A I believe they used different programs.  5 Q Okay. Do you know the difference between  6 those two programs?  7 A No.  8 Q Your statement about 10 square miles being  9 too big a block to use, I thought you testified  10 earlier that the applicant modeled -- as you  11 understood it -- as if there were no boundaries in the  12 model.  13 A Well, he used a 10 square mile.  14 Q So there was -- the applicant did depict or  15 did model a boundary condition as you describe, a 10  16 square mile boundary, correct?  17 A Yes.  18 Q So your disagreement with the applicant's  19 model is that you think the 10 square miles is too  20 big?  21 A Yes.  22 Q What model -- what square mileage would you  23 model?  24 A You would have to -- in order to model it  25 properly, you would have to go in and identify all the</p>	<p style="text-align: right;">Page 1024</p> <p>1 not make a difference in the model. Is that correct?  2 A Correct.  3 Q So as we discussed earlier, none of your  4 faults -- not a single one -- shows an offset greater  5 than 60 feet, and that's being generous, isn't it,  6 Doctor?  7 A Correct.  8 Q So if Mr. Grant, who you have adopted his  9 reservoir modeling, since you don't actually do that  10 yourself, you accepted his reservoir modeling and he  11 has dismissed a fault --  12 MR. WALKER: Your Honor, I have to  13 object at this time. I've been quite patient. I  14 believe all of this questioning is outside the scope  15 of recross.  16 MR. RILEY: It's not at all. He  17 testified about the transmissivity of faults and which  18 faults were transmissive and which faults were not  19 transmissive. He gave testimony about conduits and  20 how the subsurface geology was complex and how it  21 should be modeled.  22 JUDGE EGAN: I'm going to let you go --  23 overrule the objection, but --  24 MR. RILEY: I'm going to wrap up in 10  25 or 20 minutes.</p>

<p style="text-align: right;">Page 1025</p> <p>1 JUDGE EGAN: Thank you.</p> <p>2 MR. RILEY: Could I have the last</p> <p>3 question read back? I lost my train of thought.</p> <p>4 (The last question was read as</p> <p>5 requested)</p> <p>6 Q (By Mr. Riley) Mr. Grant found one other</p> <p>7 fault that he thought should have been considered in</p> <p>8 the area of review, correct, Doctor?</p> <p>9 A Correct.</p> <p>10 Q And he reviewed many of the same documents</p> <p>11 that you reviewed. Is that also correct?</p> <p>12 A I don't have a list of what documents he</p> <p>13 reviewed.</p> <p>14 Q All right. But in any event, he didn't think</p> <p>15 that the 50-foot offset or throw was a fault that</p> <p>16 needed to be considered in his modeling. Is that</p> <p>17 true?</p> <p>18 A Correct.</p> <p>19 Q Which faults of the ones that you've</p> <p>20 identified would you have incorporated into a model of</p> <p>21 the reservoir?</p> <p>22 A Well, if I had been doing the application, as</p> <p>23 required by the application, having identified the</p> <p>24 faults, then I have to do a determination of whether</p> <p>25 or not the fault is transmissive. And I would --</p>	<p style="text-align: right;">Page 1027</p> <p>1 consider the fault nontransmissive.</p> <p>2 Q I've asked you a different question, though,</p> <p>3 didn't I, Doctor?</p> <p>4 A I'd have to read -- I have to hear the</p> <p>5 question again.</p> <p>6 Q The question was regarding the contaminant</p> <p>7 plume, the constituent of concern to many of the</p> <p>8 people participating in this case, which is more</p> <p>9 conservative in modeling a reservoir, to consider a</p> <p>10 fault transmissive or nontransmissive, if you know?</p> <p>11 A It would be to consider it nontransmissive.</p> <p>12 Q Would be more conservative?</p> <p>13 A Yes.</p> <p>14 Q In terms of lateral extent of the plume?</p> <p>15 A Well, yes, because by -- it's the pressure</p> <p>16 buildup you're interested in and the direction in</p> <p>17 which the fluid will move.</p> <p>18 Q Now, let's go to -- pressure buildup relates</p> <p>19 to artificial penetrations, correct?</p> <p>20 A It can relate to them.</p> <p>21 Q Well, what else does it relate to?</p> <p>22 A Well, your question -- the significance of</p> <p>23 artificial penetrations?</p> <p>24 Q Yes.</p> <p>25 A The significance of artificial penetrations</p>
<p style="text-align: right;">Page 1026</p> <p>1 Q Doctor, I'm going to ask you one more time:</p> <p>2 What faults would you have included in the modeling?</p> <p>3 A And --</p> <p>4 Q I'm not asking what you interpret TCEQ</p> <p>5 requirements to be or how you would do TCEQ business</p> <p>6 if you were in fact employed by the TCEQ. I'm asking</p> <p>7 you what faults you would have employed or used in the</p> <p>8 model?</p> <p>9 A I do not know until I determine the</p> <p>10 transmissive or nontransmissive nature of the faults</p> <p>11 that are north of the northern-most fault that is --</p> <p>12 that the applicant has identified.</p> <p>13 Q So you would only consider -- if you consider</p> <p>14 additional faults, you would only consider the ones</p> <p>15 that are north and -- or west of the big red line</p> <p>16 across Exhibit 1P?</p> <p>17 A If the -- if the big red line fault was</p> <p>18 considered a nontransmissive fault, then those would</p> <p>19 be the ones to concentrate on.</p> <p>20 Q Doctor, if you know, which is more</p> <p>21 conservative in terms of determining the extent of the</p> <p>22 plume, the contaminant plume? Is it more conservative</p> <p>23 or less conservative to consider a fault transmissive?</p> <p>24 A It would be -- well, if you're looking at</p> <p>25 your pressure buildup, then it's more conservative to</p>	<p style="text-align: right;">Page 1028</p> <p>1 is they are a conduit if the pressure increases in the</p> <p>2 subsurface to move fluid up vertically.</p> <p>3 Q Okay. In fact, you gave an answer to</p> <p>4 Mr. Walker's questions explaining that artificial --</p> <p>5 regarding the study that Exxon did and the reason</p> <p>6 you're concerned about transmission in the Cockfield</p> <p>7 formation. You gave -- at least your first reason was</p> <p>8 Exxon was concerned that well bores -- the cement in</p> <p>9 wellbores had deteriorated?</p> <p>10 A Correct.</p> <p>11 Q So I assume from that that some part of your</p> <p>12 concern regarding transmission of injectate that would</p> <p>13 be part of the TexCom proposal would occur through</p> <p>14 artificial penetrations?</p> <p>15 A It could potentially, yes.</p> <p>16 Q The point I'm asking you, Doctor, is, if you</p> <p>17 know, the relationship between artificial penetrations</p> <p>18 and the pressure gradient calculated as the cone of</p> <p>19 influence?</p> <p>20 A You have to decide whether or not you're</p> <p>21 going to assume that the artificial penetrations and</p> <p>22 at what pressure they would bleed off, or if they're</p> <p>23 open when you first start the injection.</p> <p>24 Q And are you familiar with the assumptions</p> <p>25 made by Mr. Casey in his modeling regarding any</p>

<p style="text-align: right;">Page 1029</p> <p>1 artificial penetrations in the cone of influence?</p> <p>2 A I believe he regarded them -- that the -- the</p> <p>3 mud weight would be sufficient so that no fluid would</p> <p>4 move up vertically.</p> <p>5 Q And did Mr. Grant agree with those</p> <p>6 calculations?</p> <p>7 A I don't remember that.</p> <p>8 Q Are there any particular artificial</p> <p>9 penetrations that you are concerned with in this case?</p> <p>10 A Well, the applicant identifies over 200 of</p> <p>11 the artificial penetrations as having incomplete or no</p> <p>12 records on. So you have to be concerned with any of</p> <p>13 those if you have -- if you don't have the records, if</p> <p>14 you don't know what happened to the wellbores.</p> <p>15 Q So even if I had an artificial penetration,</p> <p>16 say, in -- let's pick a -- in the A-688 survey, looks</p> <p>17 like BY Sitton -- that would be an artificial</p> <p>18 penetration of concern?</p> <p>19 A The ones of concern would be one when you</p> <p>20 finished your reservoir modeling, and if it was based</p> <p>21 upon the proper parameters, then based upon that you</p> <p>22 would be especially concerned with artificial</p> <p>23 penetrations within that radius of influence.</p> <p>24 Q Okay. The cone of influence, correct?</p> <p>25 A Yes.</p>	<p style="text-align: right;">Page 1031</p> <p>1 a TCEQ public water supply database, correct?</p> <p>2 A Correct.</p> <p>3 Q I think you would agree with me that the TCEQ</p> <p>4 has access to that database, does it not?</p> <p>5 A Correct.</p> <p>6 Q I think you'd agreed with me that the</p> <p>7 applicant used the Texas Water Development Board</p> <p>8 database for its plot of water wells in the area,</p> <p>9 correct?</p> <p>10 A They used the -- the Water Board ground water</p> <p>11 database.</p> <p>12 Q Groundwater database. And those are wells</p> <p>13 that have been assigned state identification numbers,</p> <p>14 correct?</p> <p>15 A Correct.</p> <p>16 Q The additional -- what database did you</p> <p>17 use -- the additional ones I've mentioned are three,</p> <p>18 correct?</p> <p>19 A You mentioned --</p> <p>20 Q I mentioned the TCEQ public water supply</p> <p>21 database. I mentioned the Texas Water Development</p> <p>22 Board groundwater database. And you used three</p> <p>23 additional databases to come up with your number of --</p> <p>24 A We used two additional, the Lone Star</p> <p>25 Groundwater Conservation District database, and then</p>
<p style="text-align: right;">Page 1030</p> <p>1 Q So it's fair -- even though you disagree</p> <p>2 perhaps with the way the applicant did the reservoir</p> <p>3 modeling -- it is fair to look at the artificial</p> <p>4 penetrations within the cone of influence, correct?</p> <p>5 A Yes.</p> <p>6 Q Of what relevance then is your discussion --</p> <p>7 somewhat lengthy discussion -- of the water wells --</p> <p>8 artificial penetration for water wells in the area of</p> <p>9 review?</p> <p>10 A Well, as far as technical completeness and</p> <p>11 accuracy of the report, the applicant was charged with</p> <p>12 doing an inventory of any water wells within the area</p> <p>13 of review.</p> <p>14 Q So it's simply a regulatory concern, not a</p> <p>15 technical concern from the perspective of water wells</p> <p>16 being drilled into the upper, middle or lower</p> <p>17 Cockfield?</p> <p>18 A Correct.</p> <p>19 Q So again it's from a regulatory perspective,</p> <p>20 one that you don't actually have experience with, as</p> <p>21 to whether the TCEQ required the four or five database</p> <p>22 reviews that you performed in order to come up with</p> <p>23 126 water wells in the area of review?</p> <p>24 A Correct.</p> <p>25 Q And the database review that you did included</p>	<p style="text-align: right;">Page 1032</p> <p>1 the fourth one was the Water Development Board</p> <p>2 reported drillers' log database.</p> <p>3 Q Okay. Without disclosing any information</p> <p>4 regarding what you found, did you not also use -- I'm</p> <p>5 sorry, the P-2 database that relates to oil and gas</p> <p>6 exploration?</p> <p>7 A Yes.</p> <p>8 Q So the additional two databases for water</p> <p>9 wells that you used are a database where water well</p> <p>10 drillers feed that information into the Texas Water</p> <p>11 Development Board, correct?</p> <p>12 A Correct.</p> <p>13 Q Do you know of any quality control on that</p> <p>14 database or is it merely an online database available</p> <p>15 to water well drillers?</p> <p>16 A They can submit their wells online. They can</p> <p>17 all still submit them in hard copy. But they are</p> <p>18 required to submit a driller's log on every well, and</p> <p>19 there is a penalty if they -- if they're caught not</p> <p>20 submitting --</p> <p>21 Q Okay. And I think when we discussed this in</p> <p>22 your deposition, you did not know on what frequency,</p> <p>23 if any, that water well driller database migrates into</p> <p>24 the Texas Water Development Board database that</p> <p>25 assigns state well numbers, correct?</p>



<p style="text-align: right;">Page 1033</p> <p>1 A Correct.</p> <p>2 Q Similar questions regarding the Lone Star</p> <p>3 Groundwater Conservation District's database. Do you</p> <p>4 know how that database is compiled?</p> <p>5 A It's -- I don't know the exact particulars,</p> <p>6 no.</p> <p>7 Q Do you know how long the groundwater</p> <p>8 conservation district has maintained that database?</p> <p>9 A No.</p> <p>10 JUDGE EGAN: Anything further,</p> <p>11 Mr. Riley?</p> <p>12 MR. RILEY: Just one second, Judge. I'm</p> <p>13 just checking my notes. I don't believe so.</p> <p>14 No, thank you, Judge, I have no further</p> <p>15 questions.</p> <p>16 JUDGE EGAN: All right. I just want to</p> <p>17 mention for the record that Texas -- TexCom Exhibit</p> <p>18 No. 74 was never offered.</p> <p>19 MR. RILEY: Is that the -- I would like</p> <p>20 to offer that. I was going to actually use it with</p> <p>21 another witness on rebuttal, but at this time I'll</p> <p>22 offer it.</p> <p>23 JUDGE EGAN: Any objection to TexCom</p> <p>24 Exhibit No. 74?</p> <p>25 MR. WALKER: No.</p>	<p style="text-align: right;">Page 1035</p> <p>1 production from the Vicksburg and Frio formations?</p> <p>2 A I don't know the answer to that. In the area</p> <p>3 or in the Conroe field?</p> <p>4 Q Just anywhere in and around Montgomery</p> <p>5 County --</p> <p>6 A Well, in the area, that would be yes.</p> <p>7 Q Okay. And isn't the Vicksburg-Frio at a much</p> <p>8 shallower depth than the Cockfield?</p> <p>9 A Yes.</p> <p>10 Q Isn't it true that over time shallow gas</p> <p>11 deposits do seep to the surface -- over geologic</p> <p>12 time -- at a slow rate?</p> <p>13 A Yes, it can.</p> <p>14 Q And in your Exhibit 1J, the next-to-last page</p> <p>15 that showed the schematic cross sections indicating</p> <p>16 migration paths --</p> <p>17 A Yes.</p> <p>18 Q -- can a fault be transmissive of gas</p> <p>19 pressure but not transmissive of liquid pressure?</p> <p>20 A Yes.</p> <p>21 Q And how much -- how much pressure difference</p> <p>22 does there have to be for gas to migrate along a</p> <p>23 fault?</p> <p>24 A I don't know.</p> <p>25 MR. WILLIAMS: That's all, Your Honor.</p>
<p style="text-align: right;">Page 1034</p> <p>1 JUDGE EGAN: There being none, it is</p> <p>2 admitted.</p> <p>3 (TexCom Exhibit No. 74 admitted)</p> <p>4 JUDGE EGAN: All right. Did the ED have</p> <p>5 any further questions?</p> <p>6 MR. WILLIAMS: Yes, I have just three or</p> <p>7 four, Your Honor.</p> <p>8 JUDGE EGAN: All right.</p> <p>9 RECROSS EXAMINATION</p> <p>10 BY MR. WILLIAMS:</p> <p>11 Q Dr. Collier, back to your Exhibit 1G, and you</p> <p>12 mentioned under the history of the field gas seeps had</p> <p>13 been found on the Rhodes farm in the WS Rhodes survey?</p> <p>14 JUDGE EGAN: Could you move the speaker</p> <p>15 closer to you?</p> <p>16 MR. WILLIAMS: I'm sorry.</p> <p>17 Q On Page 2 of 1G, you mentioned about the gas</p> <p>18 seeps had been found on the Rhodes farm in the WS</p> <p>19 Rhodes survey?</p> <p>20 A Yes.</p> <p>21 Q Is that WS Rhodes survey anywhere within the</p> <p>22 area of review for this application?</p> <p>23 A I couldn't tell you that.</p> <p>24 Q Is it true, Dr. Collier, that in the area of</p> <p>25 the Conroe oil field there is also oil and gas</p>	<p style="text-align: right;">Page 1036</p> <p>1 Pass the witness.</p> <p>2 JUDGE EGAN: Any further redirect?</p> <p>3 MR. WALKER: Nothing further, Your</p> <p>4 Honor.</p> <p>5 JUDGE EGAN: The witness maybe excused.</p> <p>6 Thank you.</p> <p>7 WITNESS COLLIER: Thank you.</p> <p>8 JUDGE EGAN: Do y'all want to take a</p> <p>9 break at this point or --</p> <p>10 MR. WILLIAMS: A short one to put all</p> <p>11 our stuff back.</p> <p>12 JUDGE EGAN: Okay.</p> <p>13 MR. RILEY: I've got to get set up, but</p> <p>14 then I'm ready --</p> <p>15 JUDGE EGAN: How about 10 minutes?</p> <p>16 We'll reconvene at a quarter to 3:00.</p> <p>17 (Recess: 2:32 p.m. to 2:47 p.m.)</p> <p>18 JUDGE EGAN: All right. We're going</p> <p>19 back on the record. It's about 10 to 3:00 on</p> <p>20 December 17th, 2007.</p> <p>21 The court reporter mentioned to me that</p> <p>22 the -- there was some concerns about changes that were</p> <p>23 being made by the prefiled witnesses that were being</p> <p>24 made on the stand. So what I'd like each party to do</p> <p>25 after the hearing is send a letter to the court</p>

<p style="text-align: right;">Page 1037</p> <p>1 reporter of what has been changed on the prefiled  2 testimony for each person that sponsored that witness,  3 and to copy everyone on those changes so that it's  4 very clear. Any problems with that?  5 MR. RILEY: None at all.  6 JUDGE EGAN: Good. And you can do that  7 probably -- preferably before the close -- the court  8 reporter issues her final so she can incorporate it  9 into the record. So y'all get with the court reporter  10 and find out when she would like to -- or when they  11 would like to receive that. That will be fine with  12 me. And unless there's a problem, we'll accept  13 y'all's dates as being fine to do that.  14 MR. FORSBERG: Your Honor?  15 JUDGE EGAN: Yes.  16 MR. FORSBERG: I would just say for the  17 record, the -- I submitted redacted and corrected  18 versions to the court reporter, and I believe it  19 covers all of the changes that were made -- there's  20 only one that was made on the stand, but that was  21 included, and all the redactions were made.  22 JUDGE EGAN: All right. The only ones  23 we're interested are the ones that are actually made  24 on the stand, because the order -- objections we've  25 already ruled on and we're pretty clear what that is.</p>	<p style="text-align: right;">Page 1039</p> <p>1 Ms. Stewart?  2 MR. WALKER: We have no questions, Your  3 Honor.  4 JUDGE EGAN: Mr. Forsberg?  5 MR. FORSBERG: No questions, Your Honor.  6 JUDGE EGAN: Ms. Collins?  7 MS. COLLINS: I do have some questions,  8 just a couple.  9 PRESENTATION ON BEHALF OF  10 LONE STAR GROUNDWATER CONSERVATION DISTRICT  11 (Continued)  12 PHILLIP R. GRANT,  13 having been duly sworn, testified as follows:  14 CROSS-EXAMINATION  15 BY MS. COLLINS:  16 Q Mr. Grant, I'm sorry if you can't see me.  17 I'll try to lean in as much as possible.  18 I noticed on Page 5 of your prefiled  19 testimony you stated that you'd prepared numerous  20 feasibility and siting studies for clients relating to  21 the potential construction of Class I injection wells  22 for their facilities. Could you tell me what a  23 feasibility study is?  24 A Typically, prior to preparing a Class I  25 injection well permit application, a client will ask</p>
<p style="text-align: right;">Page 1038</p> <p>1 So it's just the changes that were made by each  2 witness on the stand.  3 MR. RILEY: And the only reason I  4 interrupted is there were several changes we made, but  5 we also applied a page which was marked as an exhibit.  6 Is that satisfactory? Are we okay with that or would  7 you like us to substitute --  8 JUDGE EGAN: If you've already made it  9 your letter can simply indicate they were made on the  10 record copy. And if anybody has any questions, they  11 can consult the record copy.  12 MR. RILEY: Thank you, Your Honor.  13 JUDGE EGAN: Okay. I believe we're  14 taking Mr. Grant next or is it Dr. Grant?  15 MR. GRANT: No, it's Mr. Grant.  16 JUDGE EGAN: Mr. Grant. Come on up.  17 Since there's been a huge break, let me go ahead and  18 have your sworn in again, although he is being offered  19 for cross, I believe.  20 (Witness sworn) Your  21 JUDGE EGAN: Okay. And which one of you  22 is going to be -- you had already passed and it was  23 Mr. Hill.  24 MR. HILL: That's right.  25 JUDGE EGAN: Okay. Mr. Walker or</p>	<p style="text-align: right;">Page 1040</p> <p>1 that a feasibility study -- both geologically,  2 engineering and reservoir study -- be performed to  3 determine whether the site is an applicable and  4 acceptable site to put a Class -- or to permit a Class  5 I injection well. And parameters such as geology  6 reservoir mechanics, and artificial penetrations will  7 be typically included in that feasibility analysis.  8 Q Okay. So the feasibility studies that you've  9 done are very much linked to geology and location. Is  10 that correct?  11 A Correct.  12 Q Have you done feasibility studies for any  13 other type of disposal facility?  14 A I believe in the distant past in my career  15 I've done them related to landfills.  16 Q Okay. Are those feasibility studies that  17 you've done with regard to landfills very similar in  18 that they involve whether the location and the geology  19 is suitable for the proposed activity?  20 A Yes, they are, but they're different in that  21 they deal primarily with surface features and surface  22 and near surface geology instead of deep geology.  23 Q Right. Okay. Are they at all different  24 other than the surface geology versus subsurface  25 geology?</p>

<p style="text-align: right;">Page 1041</p> <p>1 A There's no reservoir mechanics with a surface 2 facility. 3 Q Okay. 4 A That's the main difference. 5 Q Have you ever performed a feasibility study 6 that actually compared one disposal method to another? 7 A Yes. 8 Q Could you describe what those studies 9 involved? 10 A It was primarily looking at whether a high 11 total dissolved solids wastestream would be more 12 amenable to deep well injection versus evaporation, 13 incineration, or RO concentration in off-site 14 discharge. 15 Q What factors did you use in making that 16 comparison, if you can recall? 17 A The net amount of resulting waste that would 18 be left in the biosphere or on the surface, the 19 economic cost for the various alternatives and, in a 20 very limited way, the air emissions involved. 21 Q So is it fair to say in the feasibility 22 studies that you've done comparing waste disposal 23 methods, you weren't just looking at -- well, it 24 sounds like you were looking at economic feasibility, 25 perhaps even practicality. Is that correct?</p>	<p style="text-align: right;">Page 1043</p> <p>1 Q In the right circumstances. As a general 2 matter, what factors would you consider in determining 3 whether one wastewater disposal method is better than 4 another? 5 A Which is the most protective of the 6 environment. 7 Q And that involves geology and everything 8 we've been talking about, correct? 9 A Yes, a lot of different aspects. 10 Q Okay. Assuming -- so I'm -- I think I'm 11 understanding you to say that you can't tell me today 12 that overall injection is the safest form of disposal. 13 Is that correct? 14 A For aqueous liquid waste in the Gulf Coast, 15 it is one of the safer methods of wastewater disposal. 16 Q Okay. Tell me why you think that. 17 A It does not take a wastestream. And if it 18 still contains constituents that could pose a danger 19 to human health or the environment, it puts them away, 20 so to speak, into the deep subsurface where they are 21 no longer in contact with the environment -- 22 Q Assuming -- 23 A -- the surface environment. 24 Q I'm sorry, state that last part again? 25 A They are not -- they are no longer in contact</p>
<p style="text-align: right;">Page 1042</p> <p>1 A That is correct. 2 Q Okay. Was it done for a potential Class 1 3 waste -- nonhazardous waste disposal facility? 4 A Yes, it was. 5 Q Okay. And you were doing that for the 6 applicant in that matter? 7 A The potential applicant. 8 Q Potential applicant. So in your mind, does 9 feasibility involve -- does it involve the degree of 10 environmental protection as well as economics and just 11 the practicality of a location, et cetera? 12 A It involves all of those. It's on a very 13 preliminary level, which is somewhat the definition of 14 feasibility study. And the final yes/no decisions are 15 left to the client. Recommendations can be given and 16 potential disadvantages of each disposal technique can 17 be noted, but the final decision obviously is up to 18 the client. 19 Q Okay. So you're giving them a list of 20 options, basically, based on all the factors? 21 A Correct. 22 Q Okay. I think we've talked before about, 23 generally, your opinion that injection is a form of 24 wastewater disposal is a safe method, correct? 25 A In the right circumstances, yes.</p>	<p style="text-align: right;">Page 1044</p> <p>1 with the surface environment. 2 Q Okay. So assuming everything goes well and 3 as predicted, then you would prefer injection over any 4 other form of disposal. Is that correct? 5 A For certain wastes. 6 Q Okay. 7 A Primarily liquid wastewaters with low 8 concentrations of hazardous constituents. 9 JUDGE EGAN: Could you speak up just a 10 little bit? 11 WITNESS GRANT: Yes, ma'am. 12 Q (By Ms. Collins) And do you understand the 13 wastestream in this case to be one of the preferential 14 wastestreams that you just mentioned? 15 A It is a -- at least the wastestream as 16 described in the TexCom application -- appears to have 17 low levels of chemical constituents below the 18 hazardous level, which, if injected into an 19 appropriate reservoir, would be a good method of 20 disposal. 21 Q Okay. So the -- are you saying that you can 22 actually tell from the amount of information in the 23 application that this type of wastestream would be 24 among those that you would consider appropriate for 25 Gulf Coast geology?</p>

<p style="text-align: right;">Page 1045</p> <p>1 A Based upon the data that is supplied in the  2 TexCom application, no specific concentrations of the  3 various constituents are given. However, based upon  4 the general classifications of wastes and the fact  5 that it is being applied for as a nonhazardous  6 wastewater injection well, it would appear, based upon  7 what they have supplied in their application, to be an  8 appropriate type of wastestream for deep well  9 injection.</p> <p>10 MS. COLLINS: Okay. Thank you. No  11 further questions.</p> <p>12 JUDGE EGAN: All right. Would it be  13 Mr. Lee or Mr. Riley?</p> <p>14 MR. RILEY: Me.</p> <p>15 JUDGE EGAN: Okay, Mr. Riley.</p> <p>16 CROSS-EXAMINATION  17 BY MR. RILEY:</p> <p>18 Q Good afternoon, Mr. Grant.</p> <p>19 A Good afternoon.</p> <p>20 Q Mr. Grant, we've talked about this  21 application previously in deposition. Is that  22 correct?</p> <p>23 A That is correct.</p> <p>24 Q And I want to pick up to some degree where  25 Ms. Collins left off. Is it fair to say that a number</p>	<p style="text-align: right;">Page 1047</p> <p>1 Q The number of applications that you've worked  2 on for Class I injection wells, if I remember your  3 testimony correctly, is 20. Is that correct -- or  4 approximately 20?</p> <p>5 A I think that's a pretty good number. It may  6 vary -- for new well permit applications --</p> <p>7 Q It's on Page 4 of your testimony. And I  8 don't -- I wasn't trying to make a point of it other  9 than it does seem as though you've had a number of  10 applications that you've been involved with before the  11 TCEQ for the permitting of underground injection of  12 nonhazardous industrial waste through Class I  13 injection wells, and I think your answer is at least  14 20?</p> <p>15 A That would be correct.</p> <p>16 Q All right. Have you permitted any Class I  17 injection wells in the Conroe area or Montgomery  18 County?</p> <p>19 A No, I have not.</p> <p>20 Q Let's talk a little bit about -- before we  21 get into some other specifics -- the types of models  22 that were utilized in the reservoir modeling as  23 between the applicant and the model you used. We  24 talked about this in your deposition, but as I  25 understand it, you used a particular model that is</p>
<p style="text-align: right;">Page 1046</p> <p>1 of the clients you represent are engaged in the safe  2 process of liquid waste disposal into injection wells?  3 Is that correct?</p> <p>4 A That is correct.</p> <p>5 Q And I don't mean to oversimplify your  6 testimony in this matter, but I think I can sum it  7 up -- I think you do in fact sum it up in your  8 testimony -- that you disagree with certain  9 assumptions and parameters utilized by Mr. Casey in  10 his reservoir modeling. Is that correct?</p> <p>11 A That is correct.</p> <p>12 Q But otherwise you do not see the injection  13 zone -- and I'm not speaking generally. I'm talking  14 particularly the injection zone or the Jackson shale  15 or the faults that have been described by other  16 witnesses as disqualifying from an injection well  17 perspective. Is that a fair characterization?</p> <p>18 A Generally that is a fair characterization.</p> <p>19 Q Let me go a little more into the specifics.  20 But I do want to at least get clear on the record that  21 you do not see the TexCom site and its proximity to  22 the Conroe oil field as a necessary -- as necessarily  23 disqualifying TexCom from having an  24 environmentally-safe operation. Is that correct?</p> <p>25 A That is correct.</p>	<p style="text-align: right;">Page 1048</p> <p>1 used by the TCEQ or offered to applicants by the TCEQ  2 referred to as PRESS2. Is that correct?</p> <p>3 A That is correct.</p> <p>4 Q All right. And the model that was utilized  5 by Mr. Casey and, ultimately, submitted with the  6 application, is -- I've heard it referred to as  7 BOAST98 -- I think that's the way we have it in the  8 prefiled testimony -- or BOAST98. I think it's  9 BOAST98. Is that correct?</p> <p>10 A That is correct.</p> <p>11 Q Now, if I understood your deposition  12 testimony, the PRESS2 modeling is based on algebraic  13 equations, correct?</p> <p>14 A Yes, it's an analytical solution to pressure  15 increase.</p> <p>16 Q And the equations utilized in the PRESS2  17 modeling are fundamentally algebraic equations. Is  18 that correct?</p> <p>19 A That is correct.</p> <p>20 Q And the BOAST98 modeling that was utilized by  21 the applicant, I think you acknowledged in your  22 deposition that it is a more complex model that takes  23 into consideration different parameters than the  24 PRESS2 model, and is based on differential equations,  25 correct?</p>

<p style="text-align: right;">Page 1049</p> <p>1 A It's a finite difference model and uses  2 similar input parameters; however, allows for certain  3 reservoir heterogeneities which are additional  4 reservoir descriptors beyond which the PRESS2 model  5 allows.  6 Q All right. And I think I asked you, as best  7 I could articulate it, in your deposition whether you  8 thought it was more likely or less likely -- the  9 BOAST98 model was more likely or less likely to  10 predict the real life or real world conditions. Do  11 you remember those questions?  12 A I do remember those questions, yes.  13 Q Am I correct in remembering your answer was  14 yes; that because it takes into account different --  15 differing parameters, that it is more likely to  16 reproduce real world conditions?  17 A I believe my answer was that it is more  18 likely to produce a descriptor of flow and transport;  19 however, related to pressure increases, the  20 differences between the two, assuming similar inputs  21 were put in, would be very minimal.  22 Q I appreciate that clarification. That's my  23 recollection, too. But as it pertains then to flow  24 and transport or transfer of the waste -- transport of  25 the waste plume, you would expect BOAST98 to be more</p>	<p style="text-align: right;">Page 1051</p> <p>1 the TexCom application used an analytical solution  2 similar to one I would use.  3 Q And you have no disagreement with that  4 calculation in the -- in TexCom's application. Is  5 that correct?  6 A The calculation of the plume front?  7 Q Yes, sir.  8 A Not that I can recall.  9 Q It's certainly not identified in your  10 prefiled testimony to my recollection.  11 A That is correct.  12 Q So we are then back to discussing the  13 pressure -- pressure front, is that --  14 A We're essentially back to discussing the  15 pressure increase within the injection reservoir and  16 the resulting cone of influence, depending upon which  17 input parameters one uses.  18 Q All right. Now, you have -- using the PRESS2  19 model, you have modeled the reservoir using 81  20 millidarcies as your permeability. Is that the right  21 term?  22 A That is correct.  23 Q And you have input into the model or into  24 your solution using PRESS2 that the fault to the  25 south, approximately 4400 feet from WDW-315, is</p>
<p style="text-align: right;">Page 1050</p> <p>1 accurate predicting?  2 A Yes, the PRESS2 model does not predict flow  3 and transport of the waste.  4 Q Okay. In your experience then in utilizing  5 PRESS2 with the TCEQ, how do you account for flow and  6 transport in the permit applications you've worked on?  7 A For Class I nonhazardous injection well  8 permit applications, flow and transport is not solved  9 through PRESS2 or through BOAST98. It is presented as  10 an analytical solution in a formula separate from  11 PRESS2.  12 Q Okay. As between that formula separate from  13 PRESS2 and that analytical solution you described and  14 the BOAST98 model, which would you think is more  15 predictive of real world conditions?  16 A The BOAST98 model is more predictive of the  17 plume front at the end of operations and subsequent to  18 that. However, that was not used to determine the  19 plume front in BOAST98. The same analytical solution  20 was provided by the TexCom application as I would do.  21 Q Okay. I'm sorry, I misunderstood -- I didn't  22 hear the last part of what you said.  23 A The BOAST98 model was not used -- was used  24 only to predict pressure increase within the injection  25 reservoir. The determination of the plume front for</p>	<p style="text-align: right;">Page 1052</p> <p>1 nontransmissive. Is that correct?  2 A In one of my scenarios I modeled it as  3 nontransmissive. In the other I modeled it as  4 transparent (sic).  5 Q Okay. So you did it both ways, so to speak?  6 A Correct.  7 Q So the difference then in your first modeling  8 scenario was to change the permeability exclusively,  9 correct?  10 A The attempt in both models was to mimic the  11 BOAST98 model with the exception of the permeability  12 and the no-flow boundaries.  13 Q Okay. Let me try it a different way. As I  14 understand it, in the PRESS2 modeling, one of the  15 input parameters is the permeability, correct?  16 A That is correct.  17 Q And that is also true in the BOAST98  18 modeling, correct?  19 A That is correct.  20 Q In the BOAST98 modeling that Mr. Casey  21 performed, the permeability was assumed or predicted  22 to be 500 millidarcies, correct?  23 A That is correct.  24 Q And in the PRESS2 modeling that you  25 performed, the permeability in all your scenarios was</p>

<p style="text-align: right;">Page 1053</p> <p>1 assumed to be 81 millidarcies, correct?</p> <p>2 A That is correct.</p> <p>3 Q In two of the scenarios you ran for -- in the</p> <p>4 PRESS2 model, you assumed the fault to the south, the</p> <p>5 4400-foot-away fault, to be transmissive, correct?</p> <p>6 A In one of the scenarios, not two of --</p> <p>7 Q I'm sorry, I misunderstood. Okay. How many</p> <p>8 total scenarios --</p> <p>9 A Correct.</p> <p>10 Q I'm sorry. I misspoke. I apologize. So in</p> <p>11 the first scenario you did, you assumed 81</p> <p>12 millidarcies permeability and the fault to be</p> <p>13 transmissive, correct?</p> <p>14 A That is correct.</p> <p>15 Q And your conclusion was that the cone of</p> <p>16 influence would not be the 750 feet that has been</p> <p>17 clarified in this hearing that Mr. Casey calculated,</p> <p>18 it would be some 3,000 feet. Is that correct?</p> <p>19 A I would need to look at my model outputs, but</p> <p>20 I believe it was somewhere in that range of distance.</p> <p>21 Q Would you mind taking a moment and looking</p> <p>22 through it if you have it before you and confirming my</p> <p>23 recollection?</p> <p>24 A The distance would be 3170 feet.</p> <p>25 Q So your calculation that would most directly</p>	<p style="text-align: right;">Page 1055</p> <p>1 where the sands of the lower Cockfield would -- if the</p> <p>2 fault is transmissive as Mr. Casey modeled it -- would</p> <p>3 expand, so to speak, or the middle Cockfield would</p> <p>4 become available. Is that what you understood from</p> <p>5 the testimony in this case?</p> <p>6 A It was not in the TexCom application that</p> <p>7 specific delineation; however, I believe I heard</p> <p>8 Mr. Casey note that fact in his testimony.</p> <p>9 Q Okay. So in Mr. Casey's model, at 4400 feet</p> <p>10 additional sand -- assuming the fault to be</p> <p>11 transmissive between the lower Cockfield and the</p> <p>12 middle Cockfield -- becomes available, and you noted</p> <p>13 that as a difference in -- from your PRESS2 modeling,</p> <p>14 correct?</p> <p>15 A Yes, that is an additional difference.</p> <p>16 Q Okay. Are there other differences?</p> <p>17 A Not that can be compared directly between the</p> <p>18 two models.</p> <p>19 Q Okay. Let's talk about the width of the</p> <p>20 injection interval. Did you use 145 feet?</p> <p>21 A I did.</p> <p>22 Q So you didn't limit the injection interval to</p> <p>23 the 90 or so feet that is currently perforated. Is</p> <p>24 that correct?</p> <p>25 A No, the purpose of my running these two</p>
<p style="text-align: right;">Page 1054</p> <p>1 correlate with Mr. Casey's calculation is a cone of</p> <p>2 influence of 31 -- I'm sorry, 31 --</p> <p>3 A Yes, a radius of 3170 feet.</p> <p>4 Q And that would correlate to Mr. Casey's</p> <p>5 calculation of a radius of 750 feet, correct?</p> <p>6 A I'm not exactly sure what you mean by</p> <p>7 "correlation" because we didn't use the same input</p> <p>8 parameters.</p> <p>9 Q I understand. And I'm -- you use -- the only</p> <p>10 difference in that input scenario -- your input</p> <p>11 scenario and Mr. Casey's input scenario, other than</p> <p>12 the type of model you ran, which you said were</p> <p>13 equivalent -- was the permeability that Mr. Casey used</p> <p>14 was 500 millidarcies and the permeability you used was</p> <p>15 81 millidargies?</p> <p>16 A That's not the only difference between the</p> <p>17 two --</p> <p>18 Q That's what I'm trying to understand, so</p> <p>19 please explain.</p> <p>20 A The other differences in the BOAST98 model,</p> <p>21 when the fault was reached some 4400 feet to the</p> <p>22 south, the model thickness to the south expanded to</p> <p>23 some 401 feet to the south of that fault as generated</p> <p>24 or as constructed within the BOAST model.</p> <p>25 Q Okay. And that, according to Mr. Casey, is</p>	<p style="text-align: right;">Page 1056</p> <p>1 models was to make as close a comparison with the</p> <p>2 BOAST model as I could using similar input parameters,</p> <p>3 as similar as I could get, and just varying one input</p> <p>4 parameter, that being permeability.</p> <p>5 Q Your intention --</p> <p>6 A And I'm sorry -- and also whether the fault</p> <p>7 was trans -- was a fault -- a pressure barrier or not.</p> <p>8 Q Okay. So at least your attempt was to</p> <p>9 vary -- in your first scenario, which did not consider</p> <p>10 the fault 4400 feet away as nontransmissive -- Are you</p> <p>11 with me so far, the 3,173 feet that you calculated as</p> <p>12 the cone of influence?</p> <p>13 A 3,170 feet, yes.</p> <p>14 Q 170. I'm sorry. That model run, so to</p> <p>15 speak, in the PRESS2 model -- your intention was to</p> <p>16 vary only one input and that was permeability,</p> <p>17 correct?</p> <p>18 A That was my intention, yes. There were</p> <p>19 small -- the things that I could -- that I could match</p> <p>20 up -- structural dip in the BOAST model is not</p> <p>21 inputable -- to use probably the incorrect term -- but</p> <p>22 it cannot be input into the PRESS2 model. But the dip</p> <p>23 is fairly slight, so it should make very little</p> <p>24 difference as far as the pressure increase goes.</p> <p>25 Q Okay. So that -- I mean, I think I</p>

<p style="text-align: right;">Page 1057</p> <p>1 understand that the PRESS2 model simply doesn't have  2 considered in it input parameters that go into  3 BOAST98. Is that correct?  4 A There are some input parameters in BOAST98  5 that cannot be put into the PRESS2 model because of  6 the heterogeneities in the reservoir, which can be  7 added into the (inaudible)  8 THE REPORTER: I'm sorry, I didn't hear  9 the last --  10 WITNESS GRANT: The BOAST98 model.  11 Those heterogeneities essentially being in the BOAST98  12 model is -- it was modeled, the slight structural dip  13 and the change across the fault to a thicker -- to a  14 greater thickness to the south.  15 Q (By Mr. Riley) Is it accurate to say the  16 PRESS2 model considers the injection interval  17 homogenous?  18 A Could you be more clear about homogenous  19 numbers?  20 Q Well, you said that the BOAST98 accounts for  21 more heterogeneity. Is that correct?  22 A Correct.  23 Q So I would assume then, as sort of a  24 corollary to that statement, that the PRESS2 model  25 would look at the reservoir as being more homogenous.</p>	<p style="text-align: right;">Page 1059</p> <p>1 by the TCEQ prior to allowing injection to begin to  2 determine whether the Fall-off test derived  3 permeability is conservative related to the  4 calculation of the cone of influence as presented and  5 originally in the application.  6 Q So in this application the fall -- excuse me,  7 the permeability represented by the applicant, the  8 average permeability, is 500 millidarcies, correct?  9 A As represented by the applicant at -- and the  10 applicant's model is represented as 500 millidarcies.  11 Q Is it your understanding that before any  12 waste could be injected the well would have to be  13 perforated as the applicant has described in its  14 application, and a Fall-off test -- a different  15 Fall-off test would have to be conducted to confirm  16 that the 500-millidarcie assumption was conservative?  17 A If the applicant does perforate -- well, let  18 me rephrase that. This is, I guess, a unique case in  19 that the well was drilled 10 years ago. The permit  20 application has already been -- or the permit -- the  21 completion report has already been turned in and the  22 Fall-off test has already been performed, and the  23 results of that Fall-off test have been submitted.  24 What I am not sure about is whether -- although the  25 applicant states that they will perforate an</p>
<p style="text-align: right;">Page 1058</p> <p>1 A Yes, more geologically homogenous in input  2 parameters, yes, if you want to define it that way.  3 Q All right.  4 JUDGE EGAN: Mr. Grant, could you speak  5 up just a little bit or move the mic a little closer?  6 WITNESS GRANT: Is that better?  7 JUDGE EGAN: Yes. Thank you.  8 Q (By Mr. Riley) All right. With all those  9 considerations that you've described and we've  10 discussed, your objective -- at least in your first  11 model run and the PRESS2 model -- was to see what a  12 change in permeability did in terms of defining the  13 cone of influence, correct?  14 A That is correct.  15 Q As I understand it, Mr. Grant, the TCEQ UIC  16 program addresses permeability post permit -- in  17 addition to pre-permit, there's a requirement post  18 permit regarding permeability. Could you describe  19 that to the ALJs?  20 A Typically, when a new well is drilled, a  21 completion report is turned in to the TCEQ. And in  22 that completion report is a Fall-off test which has  23 calculated or determined an average permeability for  24 the perforated interval. And that average  25 permeability for the perforated interval is reviewed</p>	<p style="text-align: right;">Page 1060</p> <p>1 additional 45 feet of the lower Cockfield prior to  2 injection, that there is any vehicle regulatorily  3 required that that be done. That is the concern that  4 I have.  5 Q Now, are you familiar with the general  6 requirement in TCEQ rules that -- or, excuse me,  7 representations in permit applications are  8 enforceable?  9 A Yes, I am.  10 Q And would you consider the applicant's  11 representation that it will perforate 145 feet in the  12 existing well to be enforceable under that general  13 provision?  14 A I don't know. I don't know the answer to  15 that.  16 Q Would you consider the -- could this well --  17 assuming we weren't all here in this room and things  18 had been different under the original permit -- well,  19 let me state it differently.  20 Could the applicant inject waste if this  21 permit were granted without any further regulatory  22 process?  23 A Without --  24 Q Without a new completion report, a  25 confirmation of a Fall-off test and an authorization</p>

<p style="text-align: right;">Page 1061</p> <p>1 by the agency to accept waste, could all -- would none  2 of that have to happen if this permit application is  3 granted?  4 A I believe that's a possibility. I don't  5 think it's a possibility with the three undrilled  6 permitted wells. But because of the unique situation  7 with this well, I'm not sure that any other, quote,  8 unquote, safety checks would necessarily have to be  9 signed off on by the TCEQ before injection was  10 allowed.  11 Q All right. Could your uncertainty be  12 resolved by a condition in the permit that said that  13 the applicant must adhere to its representations --  14 whether I think that's necessary or not or TCEQ thinks  15 it's necessary or not -- if there were a condition in  16 the permit that said the applicant must perforate at  17 145 feet at a minimum of the injection interval and do  18 a Fall-off test and follow all of the requirements as  19 if this were a brand new well, would that relieve your  20 concern regarding the assumption made in the  21 application about 500 millidarcies?  22 A If the applicant were -- or if the TCEQ were  23 to include in the final draft permit that the  24 applicant perforate the additional 45 feet as noted in  25 the application, and that an additional -- a new</p>	<p style="text-align: right;">Page 1063</p> <p>1 with my colleague.  2 A The tabs are upside down.  3 (Laughter)  4 Q It's a lot of paper. Take your time.  5 A Page what?  6 Q Page 6 of 24.  7 A I have Page 6.  8 Q You see "Special Conditions G," letter G?  9 A Yes, I see that.  10 Q Okay. Does not this condition address your  11 concern regarding the permittee's obligations with  12 respect to WDW 315, which will become WDW 410?  13 A It does not address issues related to  14 specifically performing another Fall-off test.  15 Q If we added to the special condition that  16 this well would follow the path of all other wells  17 that are recompleted in different intervals that the  18 regulatory process that's in TCEQ rules would be  19 required just as it would for any other well, would  20 that address your concern?  21 A Well, the rules for recompleting into another  22 interval are not as complete as the requirements for a  23 new well as far as confirming reservoir conditions.  24 Q Fair enough. But if it were to say that this  25 would be treated as if it were a new well after</p>
<p style="text-align: right;">Page 1062</p> <p>1 Fall-off test be performed over that newly expanded  2 perforated interval, and that the results of that  3 Fall-off test be reviewed to be conservative or if an  4 enlarged cone of influence were determined to be found  5 based upon that permeability, and any additional  6 artificial penetrations within that enlarged cone of  7 influence were to be researched and found to be  8 nonendangering as far as movement into a USDW, then I  9 would feel a lot better about that, assuming the issue  10 of a nontransfer -- or a pressure boundary be  11 addressed in the modeling, I do believe that it would  12 be possible to determine if that pressure boundary is  13 there and running a new Fall-off test.  14 Q Let's explore that, because that's where I  15 want to go next. But I recognize your answer was very  16 precise and I do appreciate it. But I would like to  17 call your attention to Page No. 6 of the draft permit,  18 and Condition G.  19 A Is that in -- where would that be found in --  20 Q It's TexCom Exhibit 27, Page 6 of 24 in  21 Volume 11.  22 A Exhibit --  23 Q I'm sorry, it's Exhibit 27, Page 6 of 24.  24 A In Volume 11 there is no exhibit --  25 Q Well, I was told Volume 11. Let me confer</p>	<p style="text-align: right;">Page 1064</p> <p>1 recompletion as described in the application's --  2 detailed in that condition, would that address your  3 concern?  4 A If the specific issues, as I previously  5 stated, related to additional perforations, Fall-off  6 tests, recalculation of cone of influence,  7 reevaluation of artificial penetrations within a  8 revised cone of influence, and potential changes to  9 the operating parameters based upon the results of  10 that remodeling and determination of any artificial  11 penetration issues, were specifically addressed or  12 noted in here, then I would feel a lot -- I would feel  13 like that the concerns that I have have been -- are  14 being addressed.  15 Q All right. So that would take care of the  16 Item No. 1 that we were discussing at a minimum, which  17 would be the -- I don't mean to be coy or cute about  18 it -- but who is correct about the permeability or the  19 average permeability in the injection interval, 81  20 millidarcies versus 500, that would be addressed in  21 that process, correct?  22 A I believe the Fall-off test that would be  23 subsequently performed after reperforating would  24 address the issue of what the average permeability of  25 the injection reservoir is. That is correct.</p>



1 Q All right. And that would resolve the  
2 difference you have with the application based on a  
3 prior Fall-off test in a different interval; that  
4 would be sorted out by a subsequent Fall-off test on a  
5 new perforation if indeed that process was followed,  
6 correct?

7 A Yeah, that would -- that would answer the  
8 question related to the permeability of the reservoir  
9 and -- but not necessarily the issue of a no-flow  
10 boundary.

11 Q Okay. Let's talk about the no-flow boundary.  
12 There was some discussion -- I think you've been here  
13 for the entire hearing. If I'm mistaken, please  
14 correct me.

15 A No, that is correct.

16 Q There was some discussion of whether a  
17 Fall-off test would show a pressure boundary. And, at  
18 least in Mr. Casey's testimony, indeed a Fall-off test  
19 does indicate whether there is a pressure boundary  
20 around the well. Is that correct?

21 A Out to the radius of investigation of the  
22 Fall-off test, yes, it would be an indicator as to  
23 whether there was a no-flow boundary, an enhanced  
24 permeability or enhanced thickness boundary, and/or  
25 potentially a partially penetrating reservoir.

1 Q So again, out to the radius of investigation,  
2 which in an earlier Fall-off test was 1500 feet,  
3 correct?

4 A I believe that is correct.

5 Q The Fall-off test is useful to determine --  
6 for determining whether there are any pressure  
7 boundaries, which could include a greater  
8 transmissivity or greater permeability, or a  
9 nontransmissive fault or other barrier, correct?

10 A It would be -- Fall-off tests within the  
11 radius of investigation can provide data which, upon  
12 analysis and review of both the semi log and the log  
13 curves -- which are essentially certain analyzable  
14 drafts of a Fall-off test -- can pick up no-flow  
15 boundaries which would be potentially either a  
16 pinch-out or a laterally-sealing fault -- can, if  
17 properly performed -- again, I should make that a  
18 caveat -- also determine if there's permeability  
19 changes at some position out in the reservoir as well  
20 as determining if there is a leaky aquifer response  
21 within the reservoir.

22 Q Is there any question in your mind,  
23 Mr. Grant, that for the three wells that are not  
24 drilled, the same procedure would have to be followed  
25 under TCEQ rules? I mean, I know you have some

1 uncertainty regarding the well that's already drilled  
2 and what the requirements would be, but what about the  
3 other three wells?

4 A It is my belief that the other three  
5 undrilled wells would have to meet the standards of  
6 completion as set out in the TCEQ rules for  
7 demonstrating those specific issues.

8 Q So any uncertainty you have regarding  
9 additional Fall-off tests and pre-approval and, I  
10 guess, review of permeability and cone of influence,  
11 that attaches only to the existing well, correct?

12 A I believe that is correct.

13 Q Mr. Grant, as I understand it -- and please  
14 correct me if I'm wrong -- that the modeling  
15 associated with a Class I well that we're discussing,  
16 whether it be the PRESS2 or the BOAST98, that those  
17 models and the TCEQ requirements regarding use of  
18 those models impose very conservative assumptions. Do  
19 you agree with that?

20 A Yes, I agree with that.

21 Q And in your experience in dealing with Class  
22 I wells, have you found after completion of a well,  
23 and conducting a Fall-off test that TCEQ has been lax  
24 in its enforcement of its own requirements?

25 A Not with the permit applications that I have

1 submitted and the completion reports that I have  
2 turned in to the TCEQ. But I can only speak for my  
3 own applications.

4 Q That's all I'm asking you to do, sir.

5 How about the monitoring and reporting  
6 requirements for UIC wells in general, Class I wells,  
7 are they rigorous in your opinion?

8 A I believe they are.

9 Q Could you describe what they are, what the  
10 frequency is for additional information being  
11 submitted to the TCEQ and what the review process is?

12 A Are we talking about after the well is online  
13 and injecting?

14 Q Yes, let's talk about that. What is the  
15 process, in your experience in dealing with the TCEQ,  
16 after a well is online and injecting waste?

17 A The annulus -- or annular system must be  
18 monitored continuously for any potential loss of  
19 annulus pressure, which would be an indicator either  
20 of casing or a tubing leak above the packer.  
21 Typically, specific gravity, pH, maximum wellhead  
22 pressure are also monitored either continuously or on  
23 a regular basis.

24 Annual waste treatment analysis for  
25 wastestreams that do not vary are required to be

1 turned in with an annual report. And yearly  
2 mechanical integrity testing is required of the well,  
3 which involves both a radioactive tracer test, an  
4 annulus pressure test and an ambient pressure  
5 monitoring of the reservoir, which typically includes  
6 a Fall-off test. And that's the primary monitoring  
7 that goes on with an injection well -- Class I  
8 injection well.

9 Q And I'm not an expert on these requirements  
10 as you are, sir, but in my reading there was a  
11 requirement that if the reservoir pressure was not  
12 responding as predicted, based on these annual reviews  
13 and reports then additional conditions could be placed  
14 on the well, including shutting the well in until the  
15 pressure comes back in line. Is that your  
16 understanding?

17 A Not really. My understanding is that if  
18 the -- if the maximum injection wellhead pressure is  
19 exceeded above that which is permitted, the well has  
20 to be shut in until -- well, it cannot be exceeded.  
21 If it exceeds it, the well has to be shut in. And  
22 then it can be turned back online once the pressure  
23 decreases below that maximum, but it is not allowed to  
24 be exceeded during operation.

25 Q I'm sorry, I misunderstood that requirement.

1 The requirement then for Fall-off tests after the  
2 initial Fall-off tests, could you describe those in  
3 more detail?

4 A Typically, with the mechanical integrity  
5 testing report, which gives the result of the annulus  
6 pressure test, and the radioactive tracer test, the  
7 results of the Fall-off test -- if it's performed at  
8 the same time, and it's not required it be performed  
9 at the same time but is typically included with that  
10 report -- indicating what the calculated permeability  
11 of that Fall-off test is.

12 Q Well, I'm going to call your attention again  
13 to the same exhibit we were working with a moment ago,  
14 Page 4 of 24. This time I'm looking at Section 8 --  
15 Roman Numeral VIII, Monitoring Tests Requirements,  
16 Subsection (c). Do you find that?

17 A Yes, I do.

18 Q Could you read it into the record, please?

19 A "The pressure buildup in the injection zone  
20 shall be monitored annually, including, at a minimum,  
21 a shut down of the well for a sufficient time to  
22 conduct a valid observation of the pressure Fall-off  
23 curve."

24 Q Yeah, that's where I misunderstood the shut  
25 down requirement. But the well can be shut down while

1 this annual testing or annual Fall-off testing is  
2 done. Is that your understanding?

3 A The well has to be shut in for the Fall-off  
4 testing. That's part of the Fall-off testing.

5 Q And there is an annual requirement to conduct  
6 a Fall-off test based on the provision we just -- you  
7 just read. Is that correct?

8 A That is correct.

9 Q And if the results of that Fall-off test  
10 showed a difference in the conservative assumptions  
11 that were made in the application, what would be the  
12 process of the TCEQ in addressing the difference in  
13 the Fall-off test?

14 A I do not believe there is a vehicle for the  
15 TCEQ to do anything about that after the permit is  
16 issued as long as the maximum injection pressure --  
17 wellhead surface injection pressure is not exceeded  
18 until the time of permit renewal comes up, which is  
19 generally on a ten-year cycle.

20 At that point the accumulated Fall-off  
21 test results would be presented in a permit renewal  
22 application where the historical Fall-off tests would  
23 be incorporated into a new model, and a demonstration  
24 would be required that that model is conservative  
25 based upon the historical Fall-off tests over the life

1 of the well.

2 Q I'm sure you haven't had much experience in  
3 TCEQ enforcement, but is it your testimony that if a  
4 Fall-off test -- an annual Fall-off test indicated  
5 that there was a greater cone of influence or that  
6 there was an issue of endangerment that the TCEQ could  
7 not address it until the ten-year renewal?

8 A Typically the cone of influence is not  
9 recalculated with each year's Fall-off test analysis.

10 Just the permeability as -- or flow capacity is  
11 presented in that Fall-off test report. I do not  
12 believe that the TCEQ provides enforcement action  
13 related to an anomalous Fall-off test permeability,  
14 but provides enforcement action related to exceeding  
15 the maximum wellhead injection pressure.

16 Q I understand. The cone of influence is  
17 calculated on what timeline? My understanding -- do I  
18 understand correctly that the cone of influence  
19 contemplates 30 years of injection?

20 A Yes, the -- the application guidelines from  
21 the TCEQ require that you model it out to the  
22 projected life of the well, which the TCEQ has  
23 stated -- not arbitrarily -- but has determined to be  
24 a number to use of 30 years.

25 Q So if I understand correctly, the distances

1 that are calculated as part of the PRESS2 or BOAST98  
2 modeling -- and you've given those earlier in your  
3 testimony this afternoon -- those are distances of  
4 pressure gradient, so to speak, after 30 years of  
5 injection at maximum rates. Is that correct?

6 A For the pressure cone of influence?

7 Q Yes, sir.

8 A Yes, for 30 years. The waste plumes are, I  
9 believe, 1, 10, and 30 years.

10 Q And I'm talking about pressure right now  
11 because we'll go back to waste plume if necessary.  
12 But for the pressure calculation, which is the issue  
13 of concern for artificial penetrations, correct --

14 A Correct.

15 Q So you're looking at -- when we talk in terms  
16 of 750 feet or 3,170 feet, we're talking about where  
17 that pressure will be after 30 years of injection,  
18 correct?

19 A Where the cone of influence/endangerment  
20 pressure, which in this case I believe is 421-psi  
21 pressure increase, where that front lies within the  
22 area of review after 30 years as presented in the  
23 pressure model.

24 Q Okay. And you don't have any disagreement  
25 with the calculation of the 421 psi. Is that correct?

1 A No, I do not.

2 Q And, I'm sorry, because sometimes it's just  
3 not -- doesn't penetrate. Maybe it's late in the  
4 afternoon. But when I begin -- or say I was to begin  
5 injecting into an injection well as proposed in the  
6 TexCom application, it's not as though on the first  
7 day I inject, the pressure is felt 750 feet out from  
8 the wellbore, correct?

9 A Well, there will be -- even with a low  
10 permeability or a high permeability reservoir, there  
11 will be a pressure effect or what I would call a  
12 pressure transient that will project out a fairly  
13 substantial distance within a fairly short period of  
14 time. Not that that is going to be a 421-psi pressure  
15 increase, but the reservoir permeability or the  
16 interconnectedness of the pore space will transmit  
17 that pressure out fairly quickly to some distance.

18 Q And, I'm sorry, because I keep trying to  
19 think of things in simple terms, but eventually then  
20 that 421-psi mark moves out over 30 years to the  
21 boundary of the cone of influence as defined by the  
22 two models that were run in this case?

23 A Yeah, that cone of influence is a moving  
24 front -- if you want to put it that way -- in that  
25 after 30 years, depending upon how you model it, it

1 will be at a certain distance. But in the intervening  
2 years between zero and 30 that endangerment pressure  
3 or cone of influence gradually expands out to that  
4 distance.

5 Q So again, in my simple terms, year one it's a  
6 certain distance from the wellbore; year two -- the  
7 421 mark I'm going with -- year two is a little farther  
8 out, so on and so on, until you hit year 30 and that's  
9 where this distance is defined?

10 A And in the permit application, yes, that is  
11 correct.

12 Q Okay. Let's talk about the fault 4400 feet  
13 to the southeast of the well. You're of the opinion  
14 that the fault is not transmissive -- nontransmissive,  
15 correct?

16 A I'm of the opinion it is nontransmissive  
17 vertically and laterally.

18 Q Okay. So do you have in front of you TexCom  
19 Exhibit 72?

20 (Discussion off the record)

21 MR. RILEY: We can substitute one into  
22 the record. It wasn't marked or anything. It does  
23 seem as though maybe Dr. Collier gathered it with his  
24 belongings.

25 JUDGE EGAN: In that case, since we may

1 be substituting another copy for TexCom Exhibit No.  
2 72, Mr. Gershon, feel free to loan him your copy in  
3 the interim, if that's agreeable with everyone. If it  
4 is, thank you.

5 MR. RILEY: It certainly is with us.

6 A There's to exhibit number on this.

7 Q (By Mr. Riley) I understand. That's because  
8 the original has been -- has left the room it appears.

9 JUDGE EGAN: One of the witnesses  
10 inadvertently picked it up --

11 JUDGE WALSTON: You have the right  
12 document.

13 WITNESS GRANT: This is the correct  
14 document?

15 JUDGE EGAN: Yes.

16 Q (By Mr. Riley) Obviously, Mr. Grant, this is  
17 not drawn to scale, but let's talk about the -- what  
18 is depicted on this diagram as a fault to the right  
19 side of the diagram. Do you see that?

20 A Yes, I do.

21 Q And in rough terms, would it correspond to  
22 your understanding of the geology around the fault  
23 that we've -- you've talked about just a moment ago,  
24 the 4400-foot away fault that you say is  
25 nontransmissive?

1 A If this is the fault that they -- as drawn on  
2 here, if that's the 4400-foot fault, I do not know  
3 whether it extends up above the Jackson shale or not  
4 so I don't know if it's a true depiction of the fault  
5 at shallower horizons, whether it extends higher or  
6 not. But I do believe it does cut all of the  
7 Cockfield, upper, middle and lower.

8 Q Okay. And with that clarification or  
9 qualification, can we work with this diagram in  
10 discussing the operation of that fault in the  
11 Cockfield formation?

12 A We can. I believe the lower Cockfield is  
13 about 300-plus feet, and to my recollection the offset  
14 on this fault is somewhere between -- somewhere around  
15 150 to 200 feet. So if I were drawing this, I would  
16 show more of an offset here than what appears to be  
17 potentially about 70 feet of throw on the fault.

18 Q All right. That's fair enough.

19 A But realizing it's not to scale, however.

20 Q Yes, and that's -- I don't want to bind you  
21 to any distances or make any -- have you agree to  
22 something that clearly I don't intend. It's simply a  
23 diagram of a fault showing in rough terms the upper  
24 Cockfield, a shale layer, the middle Cockfield, a  
25 shale layer and a lower Cockfield without any

1 relationship to actual distances or even relative  
2 thicknesses to those layers. Is that fair?

3 A That is correct -- or fair, yes.

4 Q All right. Now, again, with the other  
5 qualification you had is you don't have any  
6 information on whether the fault extends above the  
7 Jackson shale, let's talk about how the fault would be  
8 nontransmissive in your opinion. Can you explain how  
9 you believe that a fault -- again, in gross terms --  
10 that's depicted in this diagram would be  
11 nontransmissive as between the Cockfield sand?

12 A Additional detail within the middle and lower  
13 Cockfield strata would show that probably close to  
14 50 percent of each one of those are -- consist of  
15 shale strata and the other 50 percent sand strata or,  
16 in the lower Cockfield, approximately 145 feet of sand  
17 to a total thickness of 300-something thickness. And  
18 these sands and shales would be interbedded both in  
19 the lower and middle Cockfield, meaning alternating  
20 sand and shale strata as you move vertically up or  
21 down the section.

22 My belief is this  
23 greater-than-50 percent or approximately 50 percent  
24 shale to sand ratio allows two mechanisms of sealing  
25 along that fault, the first being a sand-to-shale

1 juxtaposition across the fault; the second being  
2 what's called shale smearing of the fault plain, both  
3 of those, which provide a shale low permeability  
4 barrier to both fluid movement laterally and  
5 vertically and pressure movement laterally and  
6 vertically.

7 Q Okay. So if I understood what you said  
8 correctly, the -- the shale content -- and I'm not  
9 trying to pin you down on shale content -- when this  
10 fault occurred, the shale portion would have smeared  
11 across the fault line. Is that your -- am I correct  
12 in interpreting what you said?

13 A The -- yeah, it's not a one -- I don't  
14 believe it would have been on any of these a one-time  
15 event where the 150-foot of throw would have happened  
16 instantaneously. But over geologic time, potentially  
17 millions of years, this total amount of throw or  
18 offset along the fault would have occurred. And along  
19 that actual fault plain or -- it's sometimes called a  
20 gouge zone -- it's a geologic term -- that the shales  
21 or clays, because of their more putty-type  
22 constitution, would have a tendency to be smeared  
23 along that fault plain and provide a -- essentially a  
24 seal, a shale-smear type of a seal.

25 Q Okay. Would that same theory apply to faults

1 of a lesser throw or offset?

2 A Yes, it potentially could.

3 Q The sealing feature you describe seems to be  
4 somewhat at odds with Dr. Collier's testimony that all  
5 faults are transmissive -- and I mischaracterized it a  
6 little bit -- that some faults are transmissive. How  
7 do you justify those two different opinions?

8 A Well, I believe the -- the document he was  
9 referring to in the -- in his testimony was an Exxon  
10 document talking about the entire Conroe oil field set  
11 of faults, and that some of them were laterally and/or  
12 vertically transmissive.

13 I did not review all the faults,  
14 particularly the ones that were outside of the cone of  
15 influence, but I do believe that within the Conroe  
16 field there would be places where the faults could --  
17 as evidenced or as presented by Exxon -- could be  
18 laterally or vertically transmissive. However, I do  
19 not believe this specific fault is.

20 Q Okay. And, Mr. Grant, I want to understand  
21 all your reasons for believing this fault to be  
22 nontransmissive. Other than your general description  
23 of the stratum -- or strata, I suppose -- which would  
24 seem to be true no matter where a fault occurred in  
25 the Cockfield, that they are all consistently sand

1 shale layers, how would you distinguish this fault  
2 from other faults in the Cockfield?

3 A Some of the faults in the Cockfield do not --  
4 based upon the Exxon mapping -- do not provide a  
5 hydrocarbon trap. This fault provides a hydrocarbon  
6 trap where the upper Cockfield sands provide -- are  
7 reservoirs higher up in the section. The middle and  
8 lower Cockfield are apparently barren of oil and gas,  
9 but the upper Cockfield provide -- has hydrocarbon  
10 trapping. And the mechanism for that would have to be  
11 a sealed fault, because it's not a four-way closure  
12 structurally.

13 However, it is -- the hydrocarbons  
14 appear to be nestled up -- to use a non -- to use a  
15 layman's term -- but to be nestled up against the  
16 fault plain and appear to have stopped as they  
17 migrated laterally and up -- the slight structure up  
18 towards the dome would appear to have been stopped by  
19 the fault plain and form a trap that was later  
20 produced by Exxon and other operators in the field.

21 Q And that was only in -- with respect to the  
22 upper Cockfield, correct?

23 A As far as I know, there's no lower and middle  
24 Cockfield production; however, I do not believe that  
25 means that the middle and lower Cockfield sections

1 along that fault are transmissive. I do believe that  
2 the lower and middle Cockfield sands did not have --  
3 at this location and the fault block did not have  
4 hydrocarbons that ever migrated through them to come  
5 up against that fault and form a hydrocarbon.

6 Q So, for instance, on the diagram, if we  
7 looked at the shale layer between the middle Cockfield  
8 and the upper Cockfield and the offset barrier there  
9 that you claim would be nontransmissive, no  
10 hydrocarbons have ever been found in that barrier in  
11 the middle Cockfield. Is that correct?

12 A Not that I have found on any of the maps that  
13 I have reviewed.

14 Q Same question regarding the lower Cockfield  
15 and the middle Cockfield, no hydrocarbons have been  
16 produced from that nontransmissive area, if you're  
17 correct?

18 A Not that I have found.

19 Q So the solely productive zone would be --  
20 would still be the upper Cockfield, correct?

21 A As far as what I have found in the Exxon  
22 hearing files, correct.

23 Q And I assume you were diligent in your  
24 review, were you not?

25 A Yes, I believe I was.

1 Q All right. So with all your diligence and  
2 all your review, you did not find hydrocarbon  
3 production in the nontransmissive area between the  
4 lower Cockfield and the middle Cockfield, or between  
5 the middle Cockfield and the upper Cockfield, correct?

6 A Not along this specific fault, no.

7 Q Now, what is an attic? Do you know the term  
8 "attic" when referring to a fault in production of  
9 hydrocarbons?

10 A Yes, I do know what an attic is.

11 Q What is it?

12 A It's an area similar to an attic where you  
13 would have faults -- or where you would have  
14 hydrocarbons trapped.

15 Q Would you agree with me that a prime  
16 opportunity for a hydrocarbon trap in the diagram that  
17 we're looking at here, given that the upslope to these  
18 formations is toward the -- to the right of the  
19 paper -- that a hydrocarbons attic would most likely  
20 form between the Jackson and the upper Cockfield at  
21 the fault. Would you agree?

22 A Yes, I do agree with that.

23 Q So the fact that there's oil production on  
24 the northwestern side of the fault could be due to an  
25 attic formed by the Jackson shale, correct?

1 A It could be. However, it appears that the  
2 gas and oil column is greater than the amount of  
3 the -- of what you would call attic at that position.

4 Q Let's talk about in its virgin state. Do you  
5 know what I mean when say -- when I talk to or speak  
6 to virgin information?

7 A Yes, regarding a virgin oil reservoir and gas  
8 reservoir before it's been produced?

9 Q Yes, sir.

10 A Yes.

11 Q Tell me what the well information was on  
12 either side of the fault in its virgin state, if you  
13 know.

14 A What do you mean by the well information?

15 Q Well, I believe there's a point in time --  
16 and it seems rather arbitrary in my mind -- where one  
17 determines -- or geologists in particular, maybe  
18 petroleum geologists in particular -- determine how  
19 the reservoir -- what was in the reservoir at this  
20 virgin time or at this point in time called the virgin  
21 production. Do you understand what I'm saying?

22 A Yes, I do.

23 Q And that means that when the field is first  
24 discovered and wells are produced on either side of a  
25 fault, there are observations made regarding the

1 levels or the depths to which oil and gas appear,  
2 correct?

3 A Yes.

4 Q Okay. And do you know what the information  
5 available in the Exxon records and other places  
6 indicates regarding the -- this fault as it pertains  
7 to the levels of oil and gas production -- or where  
8 oil and gas was found on either side of the fault?

9 A No, I just have the structure map showing the  
10 upper Cockfield, various horizons in the upper  
11 Cockfield showing the -- a plainer view of the trap.

12 Q So my point is that if -- if it were shown  
13 that the pressures or the -- I'm sorry, I think it is  
14 the -- it is done by depth to the zone -- depth to  
15 gas, depth to oil, depth to water. Is that indicative  
16 of transmissivity across the fault or connectivity  
17 across the fault?

18 A I'm not exactly sure what you mean.

19 Q Okay. I thought you had said a moment ago  
20 that the fact that -- and I don't think I'll be able  
21 to recall your words -- that you saw differences in  
22 the -- well, let me ask you to repeat it because that  
23 would be probably a lot easier and quicker.

24 What is it about the oil and gas  
25 production that lead you to conclude that the fault

1 where I think petroleum geologists would say, "These  
2 are the characteristics of the reservoir before it is  
3 altered by production." Am I somewhere in the  
4 neighborhood of what virgin state means?

5 A Yeah, that would appear to be correct.

6 Q All right. And would, for instance, that the  
7 oil level or where you would find oil, the depth to  
8 oil, if it were the same on either side of the fault,  
9 would that indicate anything in your mind regarding  
10 the transmissivity of the fault below the attic?

11 A I think it would be inconclusive as to what  
12 it demonstrated.

13 Q Would you not agree that it is more likely  
14 than not that if, before anything is produced out of  
15 reservoir, that if I find oil at the same depth on one  
16 side of a fault as I do on the other side of a fault,  
17 that it is likely due to connectivity -- or  
18 connectivity between those two underground reservoirs?

19 A No, I wouldn't agree with that.

20 Q As a reservoir is produced, presumably the  
21 water level rises and the oil level rises with it --  
22 or the oil level rises and the water comes up behind  
23 it, correct?

24 A As what is produced?

25 Q I'm sorry, as oil or gas is produced off the

1 was not transmissive?

2 A Because it was trapped up against the fault  
3 where laterally it did not migrate across the fault.

4 Q And I think we talked about that could be due  
5 to an attic, correct?

6 A Yes, we did.

7 Q In this particular case it would seem, given  
8 that the upslope side is to the right-hand side of the  
9 paper, it would be a prime opportunity for creation of  
10 an attic in the upper Cockfield?

11 A That is correct.

12 Q So it could not -- it doesn't necessarily  
13 mean that the entire fault is nontransmissive. It  
14 means that an attic in the upper Cockfield could exist  
15 and the hydrocarbon production could occur in that  
16 area?

17 A Yes, that is possible.

18 Q Now, I was going back to before the reservoir  
19 was produced, I guess, in significant quantities over  
20 the course of the Conroe field. You would agree with  
21 me that the oil and gas reservoirs have been tapped  
22 over the course of the last 70 years or so, correct?

23 A Yes, I would agree with that.

24 Q And in its virgin state -- again back to that  
25 portion of our discussion -- there's a point in time

1 top of the formation.

2 A If the oil is produced, the gas cap could  
3 expand and potentially push the oil/water content  
4 downward. Vice versa, if the gas cap is produced, the  
5 water drive would potentially move the oil/water  
6 contact upward, depending upon which reservoir is  
7 produced. And, of course, if there's a lot of fault  
8 block, each might act independently of each other  
9 depending upon the rate at which they were produced  
10 and which hydrocarbon was produced.

11 Q Would that -- would a fault block -- well,  
12 given what you just said, the last portion of your  
13 answer, if indeed there wasn't transmission out of a  
14 fault block, wouldn't you expect them to behave  
15 differently? In other words, if they're not  
16 connected, they should not behave the same, correct?

17 A What should not behave the same?

18 Q Well, you're producing out of a well on one  
19 side of a fault. You're producing out of a well on  
20 the other side of a fault. So far okay?

21 A Okay.

22 Q And if the reservoir is behaving in a similar  
23 fashion on each side of the fault, would you expect it  
24 to be transmissive or nontransmissive?

25 A It could be either due to transmissivity or

<p style="text-align: right;">Page 1089</p> <p>1 similar production rates on both sides of the fault by  2 those two wells.  3 Q All right. What I'm imagining is in this  4 fault zone, across the fault, a pool of oil. Are you  5 with me so far?  6 A Yes.  7 Q And I'm not up to the part where the oil has  8 risen to a level where it is exclusively in the attic  9 on, let's say, the northwest side and exclusively in  10 the formation on, say, the southeast side. So far  11 okay?  12 A Yes.  13 Q So while that reservoir is being depleted or  14 withdrawn, you would expect it to behave similarly  15 across the fault if it's transmissive. Is that  16 correct?  17 A Depending upon the -- if it is transmissive,  18 depending upon the level of transmissivity it might  19 continue to balance or it might not.  20 Q Okay. So if it's a high permeable layer, say  21 1 darcy, can you draw any conclusion knowing the  22 permeability of the upper Cockfield as somewhere in  23 the order of 1 darcy or above?  24 A I don't know that that's a fact. I have no  25 indications what the permeability of the upper</p>	<p style="text-align: right;">Page 1091</p> <p>1 potential of this specific fault at the lower  2 Cockfield level.  3 Q All right. The ceiling nature of the fault  4 that you've focused on -- or that we've been  5 discussing. I shouldn't say you focused on. Do you  6 have any evidence that you can present here in this  7 case that indicates it is nontransmissive other than  8 the general characteristics of the sands we've been  9 discussing?  10 A The general characteristics of the sand, the  11 50 to 60 percent shale and 50 -- 40 percent sand  12 within the lower and middle Cockfield are the -- and  13 the amount of throw on the fault of 150 feet are, in  14 my geologic -- in my geologic experience -- is  15 indicative that that fault is very likely laterally --  16 JUDGE EGAN: Is laterally?  17 WITNESS GRANT: Yes, laterally and  18 virtually sealed.  19 JUDGE WALSTON: Sealed?  20 WITNESS GRANT: Sealed, sealing, or a  21 no-flow boundary, a pressure boundary.  22 Q (By Mr. Riley) And again, to a layperson  23 maybe this is -- just doesn't seem logical to me,  24 maybe it's not to everybody else, but the -- why  25 wouldn't this same analysis apply to any fault that is</p>
<p style="text-align: right;">Page 1090</p> <p>1 Cockfield is.  2 Q Well, assume with me for a second that it is  3 one darcy. Would the phenomena I was trying to  4 describe be more likely in a permeability of one  5 darcy?  6 A If there was no -- no shale smearing or sand  7 to shale contact across the fault, it would be more  8 likely that the levels would stay the same on both  9 sides of the fault, assuming all your other -- with  10 all your other assumptions.  11 Q All right. Did you look at that information?  12 Did you look at the virgin state of the reservoir as  13 available in the Railroad Commission records?  14 A I did not see anything related to virgin  15 pressures in the reservoir.  16 Q Would that help you in making a -- or forming  17 an opinion as to whether the fault we've been  18 discussing is transmissive or not transmissive?  19 A Not related to the lower Cockfield. It would  20 make an opinion related -- it would affect -- not  21 affect -- it would give an indication of lateral  22 transmissivity potential across the upper Cockfield  23 assuming all the production data on both sides of that  24 fault could be provided. Short of that, it wouldn't  25 necessarily give an indication as to the sealing</p>	<p style="text-align: right;">Page 1092</p> <p>1 identified in the upper, middle or lower Cockfield?  2 A Well, because the lower and the middle  3 Cockfield have more shale percentages than the upper  4 Cockfield -- not by a really huge amount, but they  5 tend to be dirtier or less clean sand in the middle  6 and lower as evidenced by previous testimony of higher  7 permeability in the upper and medium and lower  8 permeability in the middle and lower Cockfield.  9 Q Well, let me ask you a question then being  10 specific to the middle and lower. Why wouldn't the  11 same analysis apply to any fault found in the middle  12 or lower Cockfield, that it is -- since it's such a  13 high shale content -- that any faulting in those  14 layers would form nontransmissive faults both  15 laterally and vertically?  16 A And I can only speak for the one fault that I  17 have reviewed in detail, which is this fault, not all  18 the faults in the Conroe oil field. But to this  19 specific fault it would seem to me to be a strong  20 indicator that it is laterally sealed.  21 Q What about vertically sealing?  22 A Yes, I believe it's vertically ceiling.  23 Q Okay. Now, other than the throw -- or the  24 offset as we've been calling it -- what other  25 information do you have about that fault that makes it</p>

1 unique in terms of how you analyzed the available  
2 information?

3 A There's nothing else that makes it unique.

4 Q Okay. So the shale content and the throw or  
5 offset are all that you're drawing on to say that it's  
6 vertically and laterally sealing?

7 A Also my general knowledge that if you've got  
8 at least 30 to 40 percent shale in the tertiary  
9 section of the Gulf Coast you generally have a sealing  
10 mechanism -- or you often have a sealing mechanism  
11 laterally on a fault.

12 Q Let me ask you a question about the number of  
13 oil wells that are depicted on a number of different  
14 diagrams, but there's a good number of oil wells that  
15 were to the south and east -- excuse me -- yeah, south  
16 and east of the fault -- the fault that we've been  
17 discussing -- and fewer to the north and west.

18 A Correct.

19 Q Does that indicate that there's less oil and  
20 gas production from the north and west on the -- as it  
21 pertains or as it relates to the fault?

22 A No, it appears to me to indicate that as you  
23 reach the crest of the structure on the deep-seated  
24 salt feature at the Conroe field that the faulting  
25 becomes much more closely spaced or prevalent than out

1 on the flanks of the field.

2 Q All right. The difference and the  
3 distinction in all this discussion really is that you  
4 modeled the 14 -- or 4400-foot fault as a pressure  
5 barrier -- correct? -- using the PRESS2 model?

6 A That is correct.

7 Q Did you do any modeling using 500  
8 millidarcies in the PRESS2 model?

9 A Did I do any modeling -- no.

10 Q If you did modeling using 500 millidarcies as  
11 your permeability, even if you assumed the fault to  
12 the southeast, the one we've been discussing, to be a  
13 pressure barrier, what is your cone of influence?

14 A I don't know what the cone of influence would  
15 be with 500 millidarcies.

16 Q So your cone of influence that you calculated  
17 at some 14,000 feet assuming the fault to be  
18 nontransmissive is not relevant to an analysis  
19 assuming the permeability to be 500 millidarcies,  
20 correct?

21 A Not if it's 500.

22 Q So that --

23 A But I do not believe -- I did not run it with  
24 500 millidarcies because (inaudible)

25 Q I know you believe that, but we discussed --

1 JUDGE EGAN: Hold on. I couldn't hear  
2 his last answer.

3 MR. RILEY: I'm sorry, Judge.

4 JUDGE EGAN: I'm losing -- the very end  
5 is -- you fade out. What was the last part of what  
6 you said?

7 THE REPORTER: I was trying to stop you,  
8 too.

9 WITNESS GRANT: I did not use 500  
10 millidarcies in my pressure model. I used 81  
11 millidarcies because I believed that 81 millidarcies  
12 was more a appropriate value for permeability.

13 Q (By Mr. Riley) But it's only an appropriate  
14 value, Mr. Grant, if in fact the TCEQ would not  
15 require the applicant to demonstrate that 500  
16 millidarcies is conservative in its modeling and  
17 submitted with this application?

18 A It appears that the TCEQ has not -- has  
19 accepted 500 millidarcies as appropriate in that they  
20 have -- in the pressure modeling in that they have  
21 issued a draft permit with 500 millidarcies in the  
22 pressure model and discounted the actual measured  
23 average permeability for the perforated interval as  
24 presented in the completion report for WDW-315.

25 Q But we're not going to inject into WDW-315 as

1 currently perforated. You understand that?

2 A I have no --

3 Q You just read special conditions --

4 A -- does not appear to be any -- am I speaking  
5 loudly?

6 JUDGE EGAN: Yeah, you can go ahead.

7 A -- does not appear to be any guarantees or  
8 requirements in the draft permit as currently written  
9 that specifically requires TexCom to do those things  
10 as the applicant states they will.

11 Q Take a look at Page 6 of 24 -- we covered it  
12 earlier -- and the special condition letter G. I'll  
13 read it to you while you're looking, just make sure I  
14 read it correctly: "This permit is based on, and the  
15 permittee shall follow, the plans and specifications  
16 contained in the Class I underground injection control  
17 application dated July 29th, 2005 as revised," and  
18 then it gives a number of dates, "which is hereby  
19 approved subject to the terms of this permit and any  
20 other orders of the TCEQ."

21 What about that is ambiguous in your  
22 mind as to whether the applicant must recomple the  
23 well across 145 feet in the lower Cockfield zone?

24 A It's ambiguous because it does not  
25 specifically state that in there, and I believe that



<p style="text-align: right;">Page 1097</p> <p>1 that is not clear enough direction to the applicant as  2 to what they would have to do once the permit is  3 issued.  4 JUDGE EGAN: I believe, Mr. Riley,  5 you've covered this territory.  6 MR. RILEY: Thank you, Your Honor .  7 Q (By Mr. Riley) If the applicant demonstrates  8 that the permeability is 500 millidarcies based on  9 the -- your assumption that the fault to the south --  10 southeast is nontransmissive, what is the cone of  11 influence?  12 A I do not know what the cone of influence  13 would be based upon 500 millidarcies and a  14 nontransmissive fault to the south.  15 Q Would it be --  16 A I do --  17 Q Please continue.  18 A And the BOAST model as currently presented  19 not only provides a thickness of 145 feet, but  20 laterally to the south increases it to 401 feet, which  21 is obviously not the scenario of a no-flow boundary.  22 Q Well, I hear you, and that's not my question.  23 You made it very clear that you think that the fault  24 should have been modeled as a pressure boundary. And  25 you also made it very clear that you used 81</p>	<p style="text-align: right;">Page 1099</p> <p>1 nontransmissive fault for WDW 411?  2 A I do not know what it would be because I  3 cannot tell you at this point what the thickness  4 perforated would be. Therefore, it would directly  5 affect the cone of influence, and I do not know that  6 500 would be -- millidarcies would be the result of a  7 Fall-off test for those other wells.  8 Q Sir, in each of your applications, the ones  9 you've sponsored -- and I think the word is marshaled  10 through the process in your prefiled testimony -- you  11 don't have Fall-off test data for those wells, do you?  12 A No, I do not, not typically.  13 Q Okay. So that would be more typical of  14 WDW-411, correct? That would be exactly the same  15 situation?  16 A That is correct.  17 Q So in your instance and the instances you've  18 actually represented a permit applicant and assisted  19 them with their permit application, what have you  20 used? How have you determined permeability in those  21 instances?  22 A Before or after the well is drilled?  23 Q Well, before. I'm talking about a fresh, new  24 greenfield as we might refer to it where you're going  25 to put a Class I nonhazardous injection well. Are we</p>
<p style="text-align: right;">Page 1098</p> <p>1 millidarcies and you're not confident the applicant  2 would have to demonstrate any different permeability  3 to the TCEQ before injecting waste into WW-315.  4 But what about the other wells, sir?  5 Are you convinced that the TCEQ requirements,  6 regardless of your opinion about WDW-315 or future  7 WDW-410 -- are you convinced at least the other wells,  8 the other three proposed wells, would be required to  9 demonstrate that 500 millidarcies was conservative?  10 A I don't know if -- what the other wells, once  11 they were completed, would come up with as far as a  12 permeability once they are completed, but it would be  13 my opinion that the permeability is demonstrated  14 during the Fall-off testing as part of the completion  15 of those wells would be inputs -- or required to be  16 submitted to the TCEQ for review for conservativeness  17 of those -- of the pressure model for those wells.  18 Q Let's talk WDW-411.  19 A All right.  20 Q Which would have a permeability of 500  21 millidarcies demonstrated by a Fall-off test under  22 your very last answer, correct, in order to pass TCEQ  23 post-drilling review, correct?  24 A Correct.  25 Q What is the cone of influence assuming a</p>	<p style="text-align: right;">Page 1100</p> <p>1 together so far?  2 A Yes.  3 Q Is that analogous to any of the other three  4 wells WDW-411, WDW-412, and WDW -- I hope it's 413.  5 A It is analogous to those other ones, yes.  6 Q All right. So in no way does the TexCom  7 application -- is it different from applications  8 you've handled where you have not had Fall-off test  9 data for new wells, correct, or new proposed wells?  10 A It is different in that there is wells -- one  11 well exceedingly close that does have Fall-off test  12 data for the same reservoir that 411, 412 and 413 have  13 proposed for injection into.  14 Q Sir, are you required to do a Fall-off test  15 for each well you propose?  16 A Yes, I am.  17 Q Okay. So again, the Fall-off test and the  18 available data for WDW-410 is not relevant for my  19 questions regarding 411, 412 and 413. Would you  20 agree?  21 A No. It is relevant as far as the preliminary  22 modeling that you would do before you drilled the  23 well. You would use the most closest site-specific  24 permeability that you could to generate your pressure  25 model.</p>

<p style="text-align: right;">Page 1101</p> <p>1 Q So you're saying that the applicant, because</p> <p>2 it has a well with 81 millidarcies from a Fall-off</p> <p>3 test completed in a different interval than what it's</p> <p>4 proposing is bound to 81 millidarcies for all purposes</p> <p>5 in modeling the new wells?</p> <p>6 A Before the wells are drilled my belief is</p> <p>7 that it should be using 81 millidarcies until that can</p> <p>8 be either proven up or proven to be not correct.</p> <p>9 Q Well, it's going to be relatively difficult</p> <p>10 to do that unless the new zone is perforated under</p> <p>11 this permit and it is evaluated for permeability in a</p> <p>12 Fall-off test and reviewed by the TCEQ. Wouldn't you</p> <p>13 agree?</p> <p>14 A I would agree.</p> <p>15 Q So presumably then you would agree that the</p> <p>16 permit should be issued; that the Fall-off tests</p> <p>17 should be done, both in the existing well and any</p> <p>18 future wells that are drilled; and that those</p> <p>19 assumptions should be evaluated against -- excuse me,</p> <p>20 those results should be evaluated against the</p> <p>21 assumptions made in the modeling to determine whether</p> <p>22 the modeling was conservative?</p> <p>23 A For the three undrilled wells, I agree with</p> <p>24 that. For the currently-drilled well I do not believe</p> <p>25 the safeguards are in place.</p>	<p style="text-align: right;">Page 1103</p> <p>1 JUDGE EGAN: All right. Why don't you</p> <p>2 take a moment and review your notes, but it's not</p> <p>3 necessary to go back over material we already have the</p> <p>4 answers to.</p> <p>5 MR. RILEY: Thank you.</p> <p>6 (Recess: 4:32 p.m. to 4:45 p.m.)</p> <p>7 JUDGE EGAN: Is everybody ready to get</p> <p>8 back on the record? We were still in cross. You may</p> <p>9 proceed, Mr. Riley.</p> <p>10 MR. RILEY: Thank you, Your Honor.</p> <p>11 Q (By Mr. Riley) At the risk of aggravating</p> <p>12 certain folks in the room, let me just ask you some</p> <p>13 questions from your sworn deposition. By the way, I</p> <p>14 took your deposition in this case on November 28th,</p> <p>15 2007, correct?</p> <p>16 A I believe that's the case, although I'd have</p> <p>17 to check my own records as far as the date.</p> <p>18 Q Have you reviewed the transcript and have you</p> <p>19 signed the deposition?</p> <p>20 A I have.</p> <p>21 Q And were the answers in that deposition that</p> <p>22 you gave to my questions truthful?</p> <p>23 A To the best of my knowledge and intent they</p> <p>24 were.</p> <p>25 Q I'm referring to Page 65, Line 10 of that</p>
<p style="text-align: right;">Page 1102</p> <p>1 Q The safeguards in place would just be a</p> <p>2 condition that said, "Treat this as a new well, do a</p> <p>3 new Fall-off test after you've reperforated in the</p> <p>4 interval that you propose and send us the data and</p> <p>5 we'll tell you whether you can accept waste or not,"</p> <p>6 correct?</p> <p>7 A Assuming that that Fall-off test also went</p> <p>8 out a radius of investigation to determine whether the</p> <p>9 fault to the south was laterally a pressure boundary</p> <p>10 or not.</p> <p>11 Q So you would want a --</p> <p>12 JUDGE EGAN: Mr. Riley, some of these</p> <p>13 questions are getting very repetitive. I know the</p> <p>14 answers at this point and I believe Judge Walston</p> <p>15 knows the answers.</p> <p>16 MR. RILEY: I'm trying just to get the</p> <p>17 answers from the witness, Judge.</p> <p>18 JUDGE EGAN: Well, the witness has</p> <p>19 already given you the answer. He's not going to agree</p> <p>20 with you no matter how many different ways you ask it.</p> <p>21 Why don't we take a short 10-minute</p> <p>22 break and come back at quarter til 5:00, and --</p> <p>23 MR. RILEY: I think I will probably be</p> <p>24 done at that point, Judge, but I will have to review</p> <p>25 my notes just briefly.</p>	<p style="text-align: right;">Page 1104</p> <p>1 deposition. I'm going to read to you and tell me if</p> <p>2 you remember being asked these questions and giving</p> <p>3 these answers, Page 65, Line 10: "Question: So in</p> <p>4 fact if you were right that 81 millidarcies is the</p> <p>5 right value after the well is completed in the</p> <p>6 interval proposed, after all that drilling and testing</p> <p>7 is done, what would happen?</p> <p>8 "Answer: They would have to redo their</p> <p>9 pressure model --"</p> <p>10 I interrupted inadvertently with "Okay."</p> <p>11 You continued "-- to either demonstrate</p> <p>12 that there is not an endangerment issue with that</p> <p>13 lower pressure or would potentially have to go into</p> <p>14 abandoned artificial penetrations that penetrated the</p> <p>15 injection interval and replug them.</p> <p>16 "Question: So the system takes care of</p> <p>17 that, takes care of the miscalculation in the modeling</p> <p>18 submitted as part of the permit application."</p> <p>19 Your answer: "Yes, it should.</p> <p>20 "Question: All right. Is there any</p> <p>21 reason you have to doubt that that would be the</p> <p>22 process followed in this case?</p> <p>23 "Answer: No."</p> <p>24 Were those answers truthful to the</p> <p>25 questions I asked you at your deposition?</p>

<p style="text-align: right;">Page 1105</p> <p>1 A Yes, they were.</p> <p>2 Q One more set of questions on a different</p> <p>3 topic in your deposition, then I believe I'll be</p> <p>4 through. This was in -- regarding the public interest</p> <p>5 aspect of your work in developing UIC permit</p> <p>6 applications. Do you recall a series of questions</p> <p>7 regarding public interest?</p> <p>8 A I'm sure I will when you read them.</p> <p>9 Q Again, it's on Page 85, Line 1 of the</p> <p>10 deposition.</p> <p>11 "Question: And is it your opinion that</p> <p>12 it is a safe method of waste disposal?</p> <p>13 "Answer: Yes."</p> <p>14 Do you recall that being -- referring</p> <p>15 underground injection control as a method of waste</p> <p>16 disposal.</p> <p>17 A I believe so.</p> <p>18 Q "Question: In the applications that you've</p> <p>19 prepared, have you demonstrated in each occasion that</p> <p>20 the application is in the public interest?</p> <p>21 "Answer: I believe I have.</p> <p>22 "Question: And how have you done that?</p> <p>23 "Answer: Through the technical report</p> <p>24 and demonstrations within the technical report</p> <p>25 demonstrating the safety of injection in that specific</p>	<p style="text-align: right;">Page 1107</p> <p>1 this specific location is appropriate. Can you</p> <p>2 distinguish between those two?</p> <p>3 A Suitable meaning the reservoirs there which</p> <p>4 would accept fluid, appropriate in that I'm concerned</p> <p>5 about the pressure increase due to injection and the</p> <p>6 potential for artificial penetrations to serve as</p> <p>7 conduits of fluid out of the injection zone into</p> <p>8 the -- into a USDW unless certain concerns I have</p> <p>9 related to the application are addressed to my</p> <p>10 satisfaction.</p> <p>11 Q To your knowledge of the TCEQ UIC rules, is</p> <p>12 there a provision for appropriateness of an injection</p> <p>13 zone?</p> <p>14 A I'm not exactly sure what you mean by</p> <p>15 appropriateness.</p> <p>16 Q Is "appropriate" as you have used the word in</p> <p>17 your prefiled testimony defined or used in TCEQ rules?</p> <p>18 A Yes, I believe they do have in their review</p> <p>19 of a permit application -- have that requirement to</p> <p>20 determine appropriateness.</p> <p>21 Q And under -- in what context is it used?</p> <p>22 Appropriate as to the --</p> <p>23 A To location on the surface, to subsurface</p> <p>24 strata in which to inject, to defining operating</p> <p>25 parameters and permit pressure and flow maximums and</p>
<p style="text-align: right;">Page 1106</p> <p>1 location.</p> <p>2 "Question: Now, I think -- at least as</p> <p>3 best I read your testimony and heard your testimony</p> <p>4 today -- as best I am humanly capable of doing that --</p> <p>5 you have no objection to the -- from a subsurface</p> <p>6 geological perspective -- to an injection well</p> <p>7 completed in the sand that's proposed in this</p> <p>8 application. Is that correct?"</p> <p>9 "Answer: That is correct."</p> <p>10 Do you remember being asked those</p> <p>11 questions and did you give those answers --</p> <p>12 A I believe that is correct.</p> <p>13 MR. RILEY: Thank you, Mr. Grant. I</p> <p>14 have no further questions.</p> <p>15 JUDGE EGAN: Mr. Williams?</p> <p>16 CROSS-EXAMINATION</p> <p>17 BY MR. WILLIAMS:</p> <p>18 Q Good afternoon, Mr. Grant.</p> <p>19 A Good afternoon.</p> <p>20 Q You say in your prefiled testimony that you</p> <p>21 believe the area is geologically suitable for</p> <p>22 underground injection of industrial solid waste. Is</p> <p>23 that correct?</p> <p>24 A That is correct.</p> <p>25 Q But you also further say you don't believe</p>	<p style="text-align: right;">Page 1108</p> <p>1 other technical issues.</p> <p>2 Q Okay. Have all of the UIC applications that</p> <p>3 you've worked on in the past been for new wells?</p> <p>4 A No, sir. Some of them have been for permit</p> <p>5 renewals or permit amendments of existing wells.</p> <p>6 Q Have you ever converted a previous well to a</p> <p>7 Class I?</p> <p>8 A No, I have not -- you mean like an oil and</p> <p>9 gas well to a Class I or --</p> <p>10 Q Any kind of conversion.</p> <p>11 A Not that I can remember.</p> <p>12 Q Well No. 315 exists, right?</p> <p>13 A That is correct.</p> <p>14 Q Is it currently permitted?</p> <p>15 A I do not believe the current 315 permit is</p> <p>16 active at this point.</p> <p>17 Q So --</p> <p>18 A -- I'm sorry.</p> <p>19 Q That's okay. Go ahead and finish.</p> <p>20 A And the 410 permit application has -- is in</p> <p>21 draft permit stage.</p> <p>22 Q So we have a well that is in existence but</p> <p>23 not permitted. And it -- and the applicant is</p> <p>24 applying for a new permit for that well, correct?</p> <p>25 A That is correct.</p>

1 Q Then why would there be anything less than a  
2 completion report required?

3 A Because the applicant has already provided  
4 the completion report for the well as previously  
5 presented under the 315 drilling and completion. So I  
6 do not anticipate an additional completion report to  
7 be filed for 410.

8 Q If it were clear that the TCEQ would require  
9 a full, complete new completion report for 410, would  
10 that allay your fears?

11 A That would -- and all the -- all the  
12 accompanying requirements as -- of a new well,  
13 including incorporating the results of either the  
14 current Fall-off test or revised Fall-off test, if it  
15 was done, were included in that completion report and  
16 demonstrated that the modeling as currently presented  
17 is conservative -- or remodeling presented to show a  
18 new cone of influence and addressment of wells within  
19 that revised cone of influence of essentially -- and a  
20 determination of the fault being either laterally a  
21 pressure boundary or not. That would significantly  
22 allay my concerns about this application.

23 Q So you would agree that a recalculation of  
24 the area review and the cone of influence is normally  
25 done on a new well as part of the completion report.

1 Is that correct?

2 A Yes, that is -- that is typically the case.

3 Q Good. In your experience with underground  
4 injection control permits that you have worked on,  
5 aren't TCEQ rules in Chapter 331 incorporated into the  
6 permit?

7 A I believe they are.

8 Q And so if the rules were to be interpreted as  
9 requiring a full completion report on this kind of  
10 strange animal -- the conversion of an existing well  
11 previously permitted to a new permit -- then it would  
12 include all those other things -- the calculation, the  
13 area of review and the cone of influence, correct --  
14 and a new Fall-off test?

15 A If that were incorporated in specifically --  
16 and not just by rule -- but the specific checklist of  
17 issues that I have brought up, I would be -- I would  
18 feel that was --

19 Q More comfortable?

20 A Right. I would be more comfortable with  
21 that, yes.

22 Q Have you ever -- on any of the permits that  
23 you were involved in in the past, have you ever  
24 modeled a Class I well with this low permeability?  
25 A Yes, I have.

1 Q And was it permitted?

2 A Yes, it was.

3 Q Have you ever -- have you ever completed a  
4 Class I well and the permeability Fall-off -- the  
5 Fall-off test indicated a permeability higher than  
6 what you had modeled?

7 A Yes, I have.

8 Q And did the applicant or TCEQ immediately  
9 increase the amount of fluids that can be injected?

10 A No. They assumed that the -- in my case  
11 anyway -- that the modeling was conservative and left  
12 the operating parameters the same.

13 Q On the other hand, if you -- if you complete  
14 the Fall-off test and determine a permeability less  
15 than what you modeled, TCEQ demands that it be, you  
16 know, scaled back. Is that correct?

17 A They required that I present a new pressure  
18 model, and they determined certain operating  
19 parameters as to be lower or more conservative as a  
20 result of that.

21 Q But the overall effect of that is that  
22 there's less waste that can be disposed of -- is that  
23 correct -- through that well because of the lower  
24 permeability?

25 A It can be less waste, or it could be a lower

1 maximum surface injection -- flowing injection  
2 pressure.

3 Q But if there's less pressure, then there's  
4 less going down. That correct? Is that safe to say?

5 A If you don't reach your maximum wellhead  
6 pressures with a similar rate, then you could  
7 potentially inject the same amount. You would just  
8 have a -- less of a range of wellhead pressures to  
9 work with.

10 Q Okay.

11 A Maximum -- less of a maximum wellhead  
12 pressure to bump up against.

13 Q But in your experience, based on the Fall-off  
14 tests, if it's higher than what you modeled, the TCEQ  
15 will not let you automatically have extra pressure to  
16 put down the well. But if it's lower than what you  
17 modeled, they will require cutting back on the various  
18 aspects that you mentioned. Is that correct?

19 A They won't --

20 Q -- to be more conservative?

21 A They won't require or they will require?

22 Q Let me rephrase. If you do the Fall-off test  
23 and the permeability is greater -- higher than what  
24 you had modeled --

25 A Yes.

<p style="text-align: right;">Page 1113</p> <p>1 Q -- you're not automatically given the  2 opportunity to increase the amount of waste that  3 you're disposing or increase pressure or put more  4 underground. You have to stick with what you applied  5 for. Is that correct?  6 A Typically that is the case.  7 Q But if it's less, if the Fall-off test  8 pressure is less, then you're required to be more  9 conservative. Is that correct?  10 A Typically you are required -- or they -- the  11 TCEQ will require you to change some of your operating  12 parameters to stay within that new calculated  13 pressure.  14 Q And based on your Fall-off tests, if it's  15 less than what you had originally calculated or  16 modeled, aren't you also required to change and adjust  17 your area of review and cone of influence?  18 A You would have to change -- recalculate your  19 cone of influence. If it did not exceed  20 two-and-a-half miles, you would not have to change  21 your area of review.  22 Q Gotcha.  23 JUDGE WALSTON: Mr. Williams, I think  24 you said if the pressure is less, I assume meant if  25 the permeability is less --</p>	<p style="text-align: right;">Page 1115</p> <p>1 questions?  2 JUDGE WALSTON: I do.  3 JUDGE EGAN: Okay.  4 CLARIFYING EXAMINATION  5 BY JUDGE WALSTON:  6 Q I just have a couple of questions to make  7 sure I'm clear on one item. As I understand, the cone  8 of influence is the area where the pressure of the  9 injected waste is high enough that it's going to  10 overcome -- I think we talked about a mud plug,  11 correct, in an abandoned well, for example?  12 A In this application, a 421-psi pressure  13 increase within the injection reservoir -- 421 or  14 larger -- was calculated to displace a  15 9-pound-per-gallon mud plug in an old abandoned  16 borehole that had 9-pound-per-gallon mud filling it,  17 minus 50 feet of drawback from the surface.  18 Q Well, and my question to you is: Do you  19 agree that it is a reasonable assumption that one of  20 these abandoned wells is going to have a nine-pound  21 mud plug in it?  22 A Most of the wells that were plugged in -- I  23 believe in the early years of the production of this  24 oil field were probably plugged -- or likely plugged  25 only with mud. And the more recent ones are typically</p>
<p style="text-align: right;">Page 1114</p> <p>1 MR. WILLIAMS: If the permeability --  2 yes. I'm sorry. Thank you.  3 Q (By Mr. Williams) Have you ever had a well  4 for any of your clients that -- for which you had to  5 address corrective action?  6 A Could you define "corrective action" for me?  7 Q Such as your annual report indicating a  8 larger area -- a larger cone of influence and you  9 would have to go in and plug abandoned boreholes?  10 A No. In the annual report typically one does  11 not recalculate the cone of influence but provides  12 only the results of the Fall-off testing. If it's  13 included with the annual report versus included with  14 the mechanical integrity test and report, either way  15 you would present the results of your Fall-off testing  16 in a permeability value.  17 But you would not necessarily, unless  18 the TCEQ reviewer required it, go in and recalculate a  19 cone of influence. That is, at least in my  20 experience, primarily limited to the permitting or  21 permit renewal process -- or the permit amendment  22 process.  23 MR. WILLIAMS: I have no other  24 questions, Your Honor. Pass the witness .  25 JUDGE EGAN: Okay. Do you have any</p>	<p style="text-align: right;">Page 1116</p> <p>1 plugged with mud as well as cement plugs at various  2 depths within the wellbore.  3 Q Right. So that's a conservative assumption?  4 A Yes, nine-pound-per-gallon mud in it filling  5 a borehole without any other plugs of any sort is a  6 conservative assumption.  7 Q And I guess my point is for the Judges,  8 realistically we don't need to worry about some open  9 borehole without any mud or any kind of plug in it?  10 A Well, as the TCEQ assumes the most  11 conservative case is a -- sans any additional records  12 to the contrary -- assumes that a borehole of which  13 there is limited or no plugging information is assumed  14 to have that conservative situation of a  15 nine-pound-per-gallon --  16 Q That's part of the rules?  17 A That is part of the guidance document for the  18 permit application as presented by the TCEQ. That  19 does not mean that there is a borehole out there that  20 might be just filled with brine or walked away from  21 and a fence post thrown into it. But the default,  22 worst-case scenario is -- as allowed by the TCEQ  23 guidance document is nine-pound-per-gallon mud in the  24 borehole.  25 JUDGE WALSTON: Thank you.</p>

<p style="text-align: right;">Page 1117</p> <p>1 JUDGE EGAN: Anything else?</p> <p>2 JUDGE WALSTON: No.</p> <p>3 JUDGE EGAN: Mr. Hill, any redirect?</p> <p>4 MR. HILL: I do have some redirect, Your</p> <p>5 Honor.</p> <p>6 REDIRECT EXAMINATION</p> <p>7 BY MR. HILL:</p> <p>8 Q Mr. Grant, could you explain what a well</p> <p>9 conversion is?</p> <p>10 A A well conversion from -- there's many kinds</p> <p>11 of well conversions -- conversion from a oil well to a</p> <p>12 gas well to -- from a gas well to an oil well, from</p> <p>13 either one of either of those to a salt water disposal</p> <p>14 well. There's even the possibility of conversion of</p> <p>15 an oil and gas well or a dry hole which has casing in</p> <p>16 it to a Class I injection well, although that is</p> <p>17 fairly uncommon.</p> <p>18 Q Do you know if what TexCom proposes to do</p> <p>19 with WDW-315 would be considered to be a conversion</p> <p>20 under your understanding of what that term means?</p> <p>21 A No, I think it would be essentially a Class I</p> <p>22 well drilled and abandoned that another operator</p> <p>23 wishes to take as a -- to permit as a new Class I</p> <p>24 injection well.</p> <p>25 Q The point of my question was whether or not</p>	<p style="text-align: right;">Page 1119</p> <p>1 meet Class I permitting standards.</p> <p>2 Q Are you familiar with the term "workover"?</p> <p>3 A Yes, I am.</p> <p>4 Q Can you explain what that means?</p> <p>5 A A workover of a well can be due to several</p> <p>6 reasons. You can lose mechanical integrity of the</p> <p>7 well due to either a casing or tubing leak. Or you</p> <p>8 could -- and that would be -- then you would have to</p> <p>9 take the well apart, meaning take the tubing and/or</p> <p>10 packer potentially out and either put in new tubing or</p> <p>11 pack or maybe put in a casing patch, and then put the</p> <p>12 well back together.</p> <p>13 Or an additional type of workover might</p> <p>14 be to clean out sand in the bottom of the borehole to</p> <p>15 open and cover up perforations. There's many kinds of</p> <p>16 workovers, many kinds of remediations of wells for</p> <p>17 various and sundry reasons that occur.</p> <p>18 Q What about adding perforations to an existing</p> <p>19 well?</p> <p>20 A Typically adding perforations to an existing</p> <p>21 well would be considered a workover and a workover</p> <p>22 report would have to be filed.</p> <p>23 Q Okay. And can you explain what a workover</p> <p>24 report consists of, based on your experience?</p> <p>25 A Based on my experience, a daily chronology of</p>
<p style="text-align: right;">Page 1118</p> <p>1 you believe that whatever rules might exist in TCEQ</p> <p>2 rules that deal with well conversions, whether or not</p> <p>3 based on your professional experience you would expect</p> <p>4 those rules to apply to this well in this set of</p> <p>5 circumstances?</p> <p>6 A Any well, whether it was drilled as a Class I</p> <p>7 or some other format, would have to meet Class I</p> <p>8 construction and permitting standards prior to</p> <p>9 issuance of the permit and/or beginning of operations.</p> <p>10 Q So you don't believe that the conversion</p> <p>11 rules would apply to this well in this case?</p> <p>12 A I'm not sure what you're talking about when</p> <p>13 you say conversion rules.</p> <p>14 Q Well, to be honest with you, in all candor,</p> <p>15 I'm not sure what I'm talking about either, but I know</p> <p>16 Mr. Williams had mentioned the issue of conversion and</p> <p>17 I was curious to know if you thought that this well</p> <p>18 might potentially qualify as a well conversion under</p> <p>19 TCEQ rules?</p> <p>20 A I believe what -- and I can't speak for</p> <p>21 Mr. Williams, but I believe when he's talking about</p> <p>22 conversion, he's talking about a conversion of some</p> <p>23 other well type to a Class I injection well, and that</p> <p>24 would be a generic term of conversion. However, that</p> <p>25 conversion of the well would require that that well</p>	<p style="text-align: right;">Page 1120</p> <p>1 the actions performed on that well would be provided</p> <p>2 in a report, as well as a summary of the additional</p> <p>3 perforations and those depths of those additional</p> <p>4 perforations and what potential stimulation of those</p> <p>5 perforations might occur, and also a discussion of</p> <p>6 the -- if the tubing or -- if the tubing is removed to</p> <p>7 do that, the results of mechanical integrity testing</p> <p>8 after the well is put back together again would be</p> <p>9 included in that workover report.</p> <p>10 Q What about an injection Fall-off test?</p> <p>11 JUDGE EGAN: I'm sorry, I couldn't hear</p> <p>12 you.</p> <p>13 MR. HILL: I apologize, Your Honor.</p> <p>14 Q (By Mr. Hill) What about an injection</p> <p>15 Fall-off test? Is that typically part of a workover</p> <p>16 report?</p> <p>17 A To the best of my knowledge it is not</p> <p>18 typically required for a reperforating of an injection</p> <p>19 well. Operators might do it, but it's not a</p> <p>20 requirement that a Fall-off test be performed.</p> <p>21 Q Do you have access to Volume 10 of the TexCom</p> <p>22 exhibits submitted as part of the prefiled testimony?</p> <p>23 Specifically I'm referring to Exhibit 21, which, if I</p> <p>24 understand, this particular exhibit correctly, it is</p> <p>25 part of a response by TexCom for one of the -- one of</p>

<p style="text-align: right;">Page 1121</p> <p>1 the NODs submitted by TCEQ. But my question, though,  2 is specifically related to Exhibit 21, Page 21 of 47,  3 if I could draw your attention to that page.  4 A I have it.  5 Q If you would draw your attention to the first  6 paragraph on the page, under that -- under the Table  7 6-7. And specifically I'm looking at the  8 second-to-the-last-sentence of the paragraph. Let me  9 read that to you and make sure that -- let me know if  10 I don't read it correctly. "Once TGD," which I  11 believe is an abbreviation for TexCom Gulf Disposal,  12 "receives their permit for operation, the well will be  13 reperforated in more favorable portions of the  14 injection zone as described in Section 6-A.12."  15 Is there any indication in that  16 statement whether or not -- particularly when TexCom  17 proposes to conduct the additional perforations that  18 they propose as part of their application for WDW-410?  19 A No, it is stated that the well will be  20 reperforated, but it is not stated as to when.  21 Q So do you understand in reading this  22 sentence -- certainly I don't intend to put any words  23 in your mouth -- that TexCom proposes to add  24 perforations after they receive their permit, but is  25 there any particular indication there in whether or</p>	<p style="text-align: right;">Page 1123</p> <p>1 and your understanding of how the UIC program  2 operates, is there any -- do you have any  3 understanding at all whether or not even if a Fall-off  4 test was conducted, say, voluntarily by TexCom, that  5 TCEQ would be required to review that Fall-off test as  6 though it were part of a completion report -- meaning  7 that the cone of influence that was calculated by  8 TexCom as part of their application would be subject  9 to scrutiny and potential amendment by TCEQ based on  10 the results of that Fall-off test?  11 A As best I can tell, there's no requirement in  12 the permit at this point to that effect.  13 Q Let me ask you, if you wouldn't mind, to take  14 a couple of minutes with me to help maybe explain a  15 little bit about what's going on with TexCom's  16 proposal with respect to the lower Cockfield  17 specifically, I'd like to have your help in describing  18 the difference between the current perforated interval  19 of WDW-315 and the proposed injection interval that  20 TexCom describes in their application. Can you  21 define, in terms of depths the current proposed  22 injection interval that TexCom proposes to inject into  23 as part of their application?  24 A I can. I'll have to look in -- to get the  25 exact depths I'll have to look in some of their</p>
<p style="text-align: right;">Page 1122</p> <p>1 not they commit to complete those perforations before  2 the well is actually put into production or before the  3 well becomes operational?  4 A There is no indication of the time frame that  5 that will occur.  6 Q So when the applicant asks whether or not the  7 application is boot-strapped, so to speak, into the  8 terms of the draft permit itself, and I by no means  9 intend to suggest that this particular sentence  10 reflects TexCom's entire position -- there may be a  11 more detailed presentation of their plans in this  12 application that I haven't found.  13 But based on your reading of this  14 particular indication of their proposal, is there  15 anything that leads you to believe that TexCom would  16 be required, if the draft permits were issued as they  17 are proposed today for WDW 410, that they would be  18 required to conduct -- or rather that they would be  19 required to add additional perforations into the sands  20 that they considered to be more favorable and that  21 they be required to do that before operation and to  22 conduct Fall-off tests before operation?  23 A No, not that they would have to perforate  24 immediately.  25 Q And based on your understanding of TCEQ rules</p>	<p style="text-align: right;">Page 1124</p> <p>1 documents to do that.  2 Q Okay. Do you have the documents in front of  3 you? Or if I were to give you the depths would you be  4 able to discern whether or not those are accurate?  5 A If --  6 Q Let me ask you --  7 A I can find the document.  8 Q Is it your understanding that the top of the  9 proposed injection interval of TexCom is -- begins at  10 the depth of 6,045 feet?  11 A I believe that is correct.  12 Q And is it your understanding that the bottom  13 of the proposed injection interval of TexCom  14 terminates at a depth of 6,390 feet?  15 A That is correct.  16 Q And just to make sure we can correlate all  17 our data, is that also your understanding of the depth  18 of the lower Cockfield formation at WDW-315?  19 A Yes.  20 Q Okay. So within that depth of 6,045 feet  21 down to 6,390 feet, do you recall whether or not  22 WDW-315 is perforated or -- we know it's perforated  23 within that zone. Do you recall the zone that it is  24 perforated in within those depths?  25 A I would have to look that up. It's in this</p>

<p style="text-align: right;">Page 1125</p> <p>1 document here.</p> <p>2 Q Do you have that data available to you?</p> <p>3 A Not immediately. I'll have to look for it.</p> <p>4 Q Let's see if I can speed this along and ask</p> <p>5 if I were to tell you that the current perforated</p> <p>6 interval begins at a depth of 6,184 feet, does that</p> <p>7 sound accurate to you?</p> <p>8 A I believe that is the correct number.</p> <p>9 MR. RILEY: You know, Judge, I don't</p> <p>10 mind a little leading, and I certainly don't object to</p> <p>11 speeding things along. But essentially Mr. Hill is</p> <p>12 testifying for the witness, not asking questions and</p> <p>13 getting answers.</p> <p>14 JUDGE EGAN: If you believe the figures</p> <p>15 are incorrect, make your objection. But at this</p> <p>16 point, I think it's beneficial to speed things along.</p> <p>17 MR. RILEY: I understand.</p> <p>18 MR. HILL: Obviously, Your Honor and</p> <p>19 Mr. Riley, I fully expect that Mr. Grant's testimony</p> <p>20 will be subject to cross-examination as appropriate.</p> <p>21 MR. RILEY: Well, it would just be</p> <p>22 helpful for it to be his testimony unless you want to</p> <p>23 take the stand, but --</p> <p>24 JUDGE EGAN: I think that he made it</p> <p>25 real clear that he'd have to look it up and Mr. Hill</p>	<p style="text-align: right;">Page 1127</p> <p>1 that the previous operator-owner of the well decided</p> <p>2 to perforate into. Is that correct?</p> <p>3 A That is correct, of the overall perforated</p> <p>4 interval. And I believe as stated in the application,</p> <p>5 100 feet of net sand were perforated.</p> <p>6 Q Okay. And can you explain your understanding</p> <p>7 of what TexCom proposes to do with WDW -- what would</p> <p>8 be WDW-410 with respect to the perforated interval?</p> <p>9 A In the application TexCom indicates that they</p> <p>10 intend to perforate an additional 45 feet of sand --</p> <p>11 net sand within the lower Cockfield injection</p> <p>12 interval, and to reperforate some of their currently</p> <p>13 perforated interval to bring the total net perforated</p> <p>14 interval up to a maximum for the net available sand</p> <p>15 with that -- within that interval and bring it up to</p> <p>16 145 feet.</p> <p>17 Q So if I understand your testimony correctly,</p> <p>18 the proposal would be to -- well, let me ask you --</p> <p>19 would the proposal be to abandon the current 100 feet</p> <p>20 of perforated interval and find 145 feet of sand</p> <p>21 somewhere else? Or would the proposal be to</p> <p>22 incorporate that current 100 feet of sands, along with</p> <p>23 45 feet of additional sands in the lower Cockfield?</p> <p>24 A It would be to add an additional 45 feet of</p> <p>25 sand perforated and to reperforate some of the -- or</p>
<p style="text-align: right;">Page 1126</p> <p>1 is trying to refresh his memory as to whether or not</p> <p>2 those numbers are correct. If you believe they're</p> <p>3 incorrect, let me know. But otherwise, we're getting</p> <p>4 close to the end of the day and if we can finish with</p> <p>5 this witness it would be beneficial.</p> <p>6 MR. RILEY: I'm fully on board with</p> <p>7 that.</p> <p>8 Q (By Mr. Hill) If I were to tell you that the</p> <p>9 perforation of the current -- or the current</p> <p>10 perforated interval terminates at a depth of 6,372</p> <p>11 feet, does that sound correct to you?</p> <p>12 A Yes, it does.</p> <p>13 Q And do you remember in your review of the</p> <p>14 TexCom application, within that 188 feet of current</p> <p>15 perforated interval, the total extent of sands that</p> <p>16 are perforated into WDW-315?</p> <p>17 A I believe the application states that</p> <p>18 100 feet of sand -- of the sand reservoir are</p> <p>19 perforated -- of net sand reservoir.</p> <p>20 JUDGE EGAN: I'm sorry, what was it?</p> <p>21 WITNESS GRANT: Of the net sand</p> <p>22 reservoir.</p> <p>23 Q (By Mr. Hill) So that means out of the</p> <p>24 188 feet of perforated interval, there's only</p> <p>25 available 100 feet of sands to be perforated into, or</p>	<p style="text-align: right;">Page 1128</p> <p>1 possibly all of the 100 feet that is -- of net sand</p> <p>2 that is currently perforated.</p> <p>3 Q And as we've discussed -- and sounds like</p> <p>4 fully fleshed out -- a follow-up test has already been</p> <p>5 conducted on that 100 feet of perforated sand. Is</p> <p>6 that correct?</p> <p>7 A As presented in the original 315 completion</p> <p>8 report and as noted in the TexCom application. That</p> <p>9 is correct.</p> <p>10 Q And what was -- and what did the results of</p> <p>11 that injection Fall-off test tell us with respect to</p> <p>12 the permeability of those 100 feet of sands that are</p> <p>13 currently perforated in WDW-315?</p> <p>14 A It indicated that the net average</p> <p>15 permeability of that hundred feet of perforated sand</p> <p>16 is 81 millidarcies.</p> <p>17 Q You speak to average. Can you explain a</p> <p>18 little bit about that -- your use of that qualifier?</p> <p>19 A The Fall-off test analyzes the entire section</p> <p>20 or perforated interval of the reservoir that is open</p> <p>21 to receive flow during that test. And so, therefore,</p> <p>22 the results of the Fall-off test are an average for</p> <p>23 that entire hundred feet.</p> <p>24 JUDGE EGAN: I may be confused. Wasn't</p> <p>25 the perforation greater than 100 feet? The hundred</p>



<p style="text-align: right;">Page 1129</p> <p>1 feet was just of the sand?</p> <p>2 WITNESS GRANT: No, an overall</p> <p>3 perforated interval is noted of about -- from a top to</p> <p>4 a bottom of 188 feet. However, best as I can tell</p> <p>5 from the records, that was -- 188 feet was selectively</p> <p>6 perforated at various depths across the sands present</p> <p>7 in that 188 feet. And so a --</p> <p>8 JUDGE EGAN: Okay.</p> <p>9 WITNESS GRANT: -- net perforated</p> <p>10 interval was 100 feet, not 188 feet.</p> <p>11 JUDGE EGAN: I understand. Thank you.</p> <p>12 JUDGE WALSTON: Mr. Hill, just so I'm</p> <p>13 clear and the record is clear, when you started this</p> <p>14 line of questioning -- maybe I'm hearing things -- I</p> <p>15 wrote down WDW-410, but this has all been related to</p> <p>16 the existing well, WDW-315.</p> <p>17 MR. HILL: I apologize for the</p> <p>18 confusion, Your Honor. If I understand the</p> <p>19 application correctly, the existing well as it exists</p> <p>20 today at one time was permitted by TCEQ as WDW-315.</p> <p>21 That particular well, if these draft permits are</p> <p>22 issued, will be recognized by TCEQ as WDW-410.</p> <p>23 JUDGE WALSTON: Okay.</p> <p>24 MR. HILL: So there is an interchange</p> <p>25 there, and I apologize for the confusion.</p>	<p style="text-align: right;">Page 1131</p> <p>1 provide an average for the entire interval of 500</p> <p>2 millidarcies.</p> <p>3 Q Now, we do have some data on the permeability</p> <p>4 of at least portions of the strata that's not yet</p> <p>5 perforated into but is part of the lower Cockfield, do</p> <p>6 we not?</p> <p>7 A Yes, we have a 14-foot core that was taken</p> <p>8 during the drilling of 315 through one sand in the</p> <p>9 upper portion of the lower Cockfield, which is</p> <p>10 above -- about 100 feet above the currently-perforated</p> <p>11 interval.</p> <p>12 Q And if you recall, was a test conducted to</p> <p>13 determine the potential or the permeability of those</p> <p>14 sands that were bored?</p> <p>15 A Plugs out of that 14 feet of core probably</p> <p>16 on -- 2-inch plugs were drilled out of -- five 2-inch</p> <p>17 plugs were drilled out of that 14 feet and submitted</p> <p>18 to a petrophysical laboratory for analysis of</p> <p>19 permeability and porosity, and the results of those</p> <p>20 analyses are included in the completion report for</p> <p>21 315.</p> <p>22 Q Do you recall what the results of those tests</p> <p>23 suggested?</p> <p>24 A They provided a range of permeabilities of</p> <p>25 over 800 millidarcies to approximately 6 millidarcies</p>
<p style="text-align: right;">Page 1130</p> <p>1 JUDGE WALSTON: Okay.</p> <p>2 Q (By Mr. Hill) The applicant has suggested</p> <p>3 that the permeability -- the applicant has suggested</p> <p>4 that they anticipate the average permeability of the</p> <p>5 entire lower Cockfield -- that is all of the 145 feet</p> <p>6 of available sands acceptable to receive injected</p> <p>7 waste is somewhere around -- well, is 500</p> <p>8 millidarcies. Is that correct?</p> <p>9 A Yes.</p> <p>10 Q Can you explain why you believe, based on --</p> <p>11 let me take a step back. You put a lot of importance</p> <p>12 on the data from the current 100 feet of perforated</p> <p>13 sands, do you not?</p> <p>14 A Yes, I believe it is representative of the</p> <p>15 perforated reservoir at this time.</p> <p>16 Q Okay. How -- can you explain then, based on</p> <p>17 that information, why you believe 500 millidarcies is</p> <p>18 an unrealistic expectation of what that -- the</p> <p>19 permeability of those 145 feet of sands would likely</p> <p>20 be?</p> <p>21 A Well, to get -- to add an additional 45 feet</p> <p>22 of perforation of sand to get a maximum reservoir</p> <p>23 thickness in the injection interval of 145 feet, one</p> <p>24 would have to have a permeability of the remaining</p> <p>25 45 feet exceed something like 1400 millidarcies to</p>	<p style="text-align: right;">Page 1132</p> <p>1 with, I think, an average of those five cores of</p> <p>2 approximately 390 millidarcies as stated in the core</p> <p>3 analysis report.</p> <p>4 Q Do you have Volume 9 of the TexCom prefiled</p> <p>5 testimony available to you?</p> <p>6 A Yes, I do.</p> <p>7 Q Would you turn your attention to TexCom</p> <p>8 Exhibit 11, specifically Page 146 of 270?</p> <p>9 MR. RILEY: I'm sorry, what page</p> <p>10 counsel?</p> <p>11 MR. HILL: 146 of 270.</p> <p>12 A Yes, I have it.</p> <p>13 Q Could you explain what -- what the data on</p> <p>14 this page --</p> <p>15 JUDGE WALSTON: Give us second --</p> <p>16 MR. HILL: Sorry.</p> <p>17 JUDGE EGAN: Exhibit 11?</p> <p>18 JUDGE WALSTON: Go ahead.</p> <p>19 Q (By Mr. Hill) When you were referring to the</p> <p>20 ranges of the core samples taken, is this the</p> <p>21 information you were referring to?</p> <p>22 A Yes, it was.</p> <p>23 Q Could you specifically point us -- there's</p> <p>24 several columns of information here. Could you point</p> <p>25 is to the columns that you're referring to?</p>

<p style="text-align: right;">Page 1133</p> <p>1 A There are two subcolumns under the  2 permeability millidarcies column. And there are five  3 sample depths to the left of that showing the depths  4 at which the core plugs were taken and the results of  5 permeability analyses.</p> <p>6 The permeability is typically -- in this  7 form of analysis -- run using air to flow through the  8 core and then a correction factor for liquid, which is  9 a Klinkenberg correction factor is applied to those  10 results, which typically is more reflective of the  11 conditions of the rock when fluid is -- as you would  12 have in a natural subsurface environment. And those  13 permeabilities for those five depths are noted on the  14 Klinkenberg 2000 psi column.</p> <p>15 Q Based on this particular set of data and  16 based on your understanding of the sand and shale  17 composition of the lower Cockfield and based on your  18 understanding of the results of the Fall-off testing  19 that was taken on WDW-315, do you have any reason to  20 believe that the 45 feet of remaining sands in the  21 lower Cockfield will have a permeability in excess of  22 1400 millidarcies once tested?</p> <p>23 A It's unlikely in that the results of this  24 core analysis do not provide any analysis showing that  25 high a permeability value.</p>	<p style="text-align: right;">Page 1135</p> <p>1 pressure increase of 421 psi of approximately, I  2 believe, 3170-a-foot radius from the injection well  3 from 315.</p> <p>4 The second one -- in which case the  5 fault to the south is considered a no-flow boundary --  6 has a -- has a radius of the cone of influence  7 directly to the north of something like 2.7 miles.</p> <p>8 Q Well, let's -- do you have your prefiled  9 testimony in front of you?</p> <p>10 A I do.</p> <p>11 Q Can you flip expediently to the pressure  12 models that you conducted and let us know where you're  13 looking with respect to prefiled testimony?</p> <p>14 A In my prefiled testimony, Exhibits 12 and 13  15 have my two scenarios of pressure modeling. And 12 is  16 a laterally-transmissive fault in which the cone of  17 influence is -- all the way to the bottom of the table  18 there -- it has a distance of 3170 feet from the  19 injection well.</p> <p>20 Q Okay.</p> <p>21 A The second scenario in which the fault is  22 considered a no-flow boundary has a cone of influence  23 directly to the north of approximately 14,300 feet  24 from the injection well. This cone of influence would  25 necessarily be expanded a greater distance as one</p>
<p style="text-align: right;">Page 1134</p> <p>1 Q So I'll ask: Is it possible that those sands  2 could be very clean sands, it could have a very high  3 permeability, so that the average permeability of the  4 entire injection interval would be 500 millidarcies?</p> <p>5 A It is possible, but based upon the data here  6 it's extremely unlikely.</p> <p>7 Q Okay. Now, of course, the bottom line is --  8 is whether or not the 500-millidarcy assumption used  9 by the applicant in their pressure modeling in their  10 application is a -- a figure that is sufficiently  11 conservative to be adequately protective of human  12 health and the environment, and my question is do you  13 believe that the 500-millidarcy figure is that  14 conservative figure?</p> <p>15 A No, I do not.</p> <p>16 Q Okay. Let me take a step back. You ran two  17 models on your own as part of your review of this  18 application. Isn't that correct?</p> <p>19 A That is correct.</p> <p>20 Q Can you explain -- without going into a  21 tremendous amount of detail -- can you explain the  22 differences in the cones of influence, with respect to  23 each model, meaning differences in feet from wellbore?</p> <p>24 A The first -- or one of the models has a  25 resultant cone of influence which is defined by a</p>	<p style="text-align: right;">Page 1136</p> <p>1 moved laterally along the fault due to the fact that  2 there would be no pressure dissipation south of the  3 fault.</p> <p>4 So although I did not calculate it, it  5 would have a -- kind of a squashed moon shape and  6 would be further out to the west and east along the  7 fault line.</p> <p>8 Q Based on -- and let's make the record  9 clear -- the input values you used for these models  10 were what with respect to permeability and thickness?</p> <p>11 A I was trying to match the BOAST model as best  12 I could and using only the difference of permeability  13 as compared to the applicant's model, and issues of  14 transmissivity or pressure boundary of the fault to  15 the south -- the fault to the south acting as a  16 no-flow boundary.</p> <p>17 Q For the purposes of modeling in a Class I UIC  18 application, based on your experience with putting  19 these applications together, which do you believe,  20 based on all the data that you have available to you  21 in this application, to be the more conservative value  22 with respect to the anticipated permeability of the  23 injection reservoir proposed by TexCom, 500  24 millidarcies or 81 millidarcies?</p> <p>25 A I believe 81 millidarcies is a more</p>

<p style="text-align: right;">Page 1137</p> <p>1 conservative value.</p> <p>2 Q And for purposes of that same modeling for</p> <p>3 the same type of application, which do you believe to</p> <p>4 be a more conservative value with respect to modeling,</p> <p>5 a -- considering the fault 4400 feet to the south of</p> <p>6 315 to be laterally transmissive or laterally sealing?</p> <p>7 A Laterally sealing.</p> <p>8 Q Let me ask you again, Mr. Grant, whether or</p> <p>9 not you believe, if these draft permits were issued</p> <p>10 today, that TexCom would be required to conduct any of</p> <p>11 the perforations -- and certainly whether or not they</p> <p>12 would be required to subject any of that additional</p> <p>13 work to Fall-off testing -- and have all that work be</p> <p>14 subject to scrutiny of TCEQ before that well WDW-410</p> <p>15 could be put into operation?</p> <p>16 A No, I do not believe that those safeguards</p> <p>17 are in place as the permit is currently written -- as</p> <p>18 this draft permit is currently written.</p> <p>19 MR. HILL: One second, Your Honor.</p> <p>20 Q One last question, Mr. Grant. Can you please</p> <p>21 explain, in as simple terms as you can come up with,</p> <p>22 what type of Fall-off test would be required to allow</p> <p>23 us to know, with some degree of reliability, whether</p> <p>24 or not the fault to the south is laterally sealing?</p> <p>25 A A Fall-off test under the either current or</p>	<p style="text-align: right;">Page 1139</p> <p>1 completion report?</p> <p>2 A Typically there is no preset distance that --</p> <p>3 for a radius of investigation that one would have to</p> <p>4 run the Fall-off test for. So typically a Fall-off</p> <p>5 test would be run long enough until you got into a</p> <p>6 radial flow period and then the Fall-off test ended</p> <p>7 once you're in a radial flow period. This kind of a</p> <p>8 test would be extended out a time frame to necessarily</p> <p>9 reach a radius of investigation past the distance of</p> <p>10 the fault to the south.</p> <p>11 MR. HILL: I have no further questions,</p> <p>12 Your Honor.</p> <p>13 JUDGE EGAN: Okay. Mr. Walker?</p> <p>14 MR. WALKER: No questions, Your Honor.</p> <p>15 JUDGE EGAN: Mr. Forsberg?</p> <p>16 MR. FORSBERG: I have no questions, Your</p> <p>17 Honor.</p> <p>18 JUDGE EGAN: Ms. Collins?</p> <p>19 MS. COLLINS: No questions.</p> <p>20 JUDGE EGAN: Mr. Riley?</p> <p>21 MR. RILEY: Just a few, and I'll try to</p> <p>22 be very quick.</p> <p>23 JUDGE EGAN: That's okay.</p> <p>24</p> <p>25</p>
<p style="text-align: right;">Page 1138</p> <p>1 additional perforated conditions should be run long</p> <p>2 enough so that any pressure boundary or no-flow</p> <p>3 boundary located to the south at the fault some</p> <p>4 4400 feet away would show up in the data -- in the</p> <p>5 analysis of that data. And that can be calculated</p> <p>6 while -- prior to the test based upon an estimated</p> <p>7 permeability.</p> <p>8 And it can be confirmed during the test</p> <p>9 before the test is over by doing analyses of the data</p> <p>10 as gathered to that point and looking for indications</p> <p>11 of boundaries or not. And determinations can be run</p> <p>12 as the Fall-off test is in progress from the data as</p> <p>13 gathered what your radius of investigation is. And a</p> <p>14 radius of investigation for the Fall-off test should</p> <p>15 extend beyond 4400 feet, not just to it, but some</p> <p>16 distance beyond it to confirm or disprove whether a</p> <p>17 no-flow boundary or some other kind of a barrier is</p> <p>18 present for that location.</p> <p>19 Q And just as a quick follow-up, how much of</p> <p>20 more of an undertaking would that test be -- that</p> <p>21 particular breadth of a Fall-off test be -- how much</p> <p>22 more of an undertaking would that be over and above</p> <p>23 what you would normally be required to do under TCEQ</p> <p>24 rules as if this were a brand new well and you were</p> <p>25 constructing a Fall-off test for the purposes of a</p>	<p style="text-align: right;">Page 1140</p> <p>1 RECROSS-EXAMINATION</p> <p>2 BY MR. RILEY:</p> <p>3 Q Mr. Grant, did anything that Mr. Hill asked</p> <p>4 you about change your opinion that with a Fall-off</p> <p>5 test demonstrating an average permeability of 500</p> <p>6 millidarcies and a radius of investigation out beyond</p> <p>7 the fault would relieve your concerns regarding the</p> <p>8 review of this application?</p> <p>9 A If those things -- what were the two things</p> <p>10 again?</p> <p>11 Q Reperforation of the well, which we've been</p> <p>12 referring to interchangeably as WDW-315 and WDW-410,</p> <p>13 those are the same well, correct?</p> <p>14 A Yes, that is correct.</p> <p>15 Q So if that was reperforated as proposed in</p> <p>16 the TexCom application, and a Fall-off test was done</p> <p>17 that had a radius of investigation out beyond the</p> <p>18 fault to the southeast, the 4400-foot away fault --</p> <p>19 say the radius of investigation went out 4600 feet,</p> <p>20 would it relieve any concern you have if it proved two</p> <p>21 things -- one, that the permeability was greater than</p> <p>22 500 millidarcies and, two, that there was no boundary</p> <p>23 determined by the Fall-off test at 4400 feet?</p> <p>24 A Yes, that would alleviate many of my</p> <p>25 concerns. What I would -- I would think would be</p>

1 appropriate would be not -- since we don't the exact  
2 location of fault -- would not necessarily to take it  
3 an additional 200 feet past but, say, potentially a  
4 thousand feet past 4400 feet. And that would entail  
5 just running the fault injection period of the test in  
6 the Fall-off period longer.

7 Q And those -- that is achievable with the  
8 Fall-off test? In other words, that distance is  
9 something that can commonly -- or is commonly  
10 investigated by a Fall-off test. Is that correct?

11 A Yes, there's -- there are numerous Fall-off  
12 tests, depending upon the permeability, of course, and  
13 the thickness to where you would get distances out 8,  
14 10,000 feet of investigation depending upon the length  
15 of the test.

16 Q All right. Let's go back just quickly now to  
17 the terminology used in redirect examination. There's  
18 something called the injection zone, correct? And  
19 that is the full interval as described in the TexCom  
20 application for the lower Cockfield, correct?

21 A No, the injection zone is the upper, middle  
22 and lower Cockfield.

23 Q Okay. But in terms of the sand, you're  
24 correct. I'm sorry. In terms of the sand that we're  
25 talking about, we're talking about the lower Cockfield

1 and its thickness in the area of WDW -- I'll use  
2 310 --

3 A 315.

4 Q -- 315. I'm sorry. 315. It's approximately  
5 345 feet. Is that correct?

6 A The gross thickness of the injection interval  
7 is approximately that, correct.

8 Q Now, when we talk about an injection interval  
9 and Mr. Hill asked you some questions about the  
10 hundred foot of sand that is currently perforated,  
11 we're talking about some portion of that hundred  
12 feet -- excuse me, of that 345 feet --

13 A That is correct.

14 Q And you indicated that's about 188 feet of  
15 that 345 feet, but it is netted for the actual -- for  
16 the actual perforation. In other words, within that  
17 188 feet the current well is perforated in  
18 approximately 100 feet?

19 A It's perforated in approximately 100 feet of  
20 sand.

21 Q I'm sorry. Just to be clear -- I don't mean  
22 to cut you off. I apologize.

23 A I suppose there might be some perforations in  
24 shales. But as defined -- or as presented in the  
25 TexCom application, 100 feet of sand have been

1 perforated in that 188 feet interval.

2 Q Okay. So if I took -- again just for  
3 purposes of clarity -- 188 feet and the first 2 feet I  
4 perforate, that's 2, correct?

5 A Yeah, if it's in -- if we're counting towards  
6 the 100 feet, it would have to be 2 feet in a sand.

7 Q That's right. So I perforate 2 feet in a  
8 sand, then go down -- in other words, it's a  
9 cumulative total, and it totals to a net of 100 feet.

10 A Yes. And I don't know from the records  
11 whether it was -- I believe it was selective  
12 perforations across sands to come up with 100 feet. I  
13 don't believe the entire 188 feet, which includes many  
14 shales, was entirely -- that interval was perforated.

15 Q Okay. Is there a -- and I'm going to use  
16 terms that I only basically understand. Is there a  
17 number of shots-per-foot that is standard in the  
18 industry for a perforation?

19 A I'm not a petroleum engineer, but to my  
20 experience it is typically somewhere between 2 to 4  
21 shots per foot, depending upon your perforating guns.

22 Q Okay. If the current well were perforated at  
23 2 shots-per-foot and the intention is to perforate it  
24 at 4 slots per foot, would you agree that that could  
25 increase the permeability in the well, assuming

1 nothing else?

2 A No -- are you talking about re-perforating a  
3 specific sand and then changing the permeability of  
4 that specific sand that's already been perforated?

5 Q I'm saying that within the foot -- interval  
6 of a foot it seems like there's a number of shots that  
7 are currently perforated. In other words, there are 2  
8 shots-per-foot, I'm led to believe.

9 A I don't have a confirmation of that, but if  
10 you're saying it's 2 shots-per-foot, I'll assume  
11 that's the case.

12 Q Okay. And if it's increased to 4  
13 shots-per-foot, would that change the results of a --  
14 that fact alone, nothing else -- change the results of  
15 the Fall-off test? Do you know?

16 A I do not believe so. It will open more of  
17 that 1 foot of sand -- more holes into it and  
18 potentially, on a Fall-off test, decrease your skin.  
19 But there's no direct correlation to increasing your  
20 permeability since you're still looking at the same 1  
21 foot sand whether it has 2 shots-per-foot in it or 4  
22 shots-per-foot put in it.

23 Q Okay.

24 A Skin being, you know, friction pressure loss  
25 due to a fluid movement out of those perforations into

<p style="text-align: right;">Page 1145</p> <p>1 the -- into the formation sand.</p> <p>2 Q Okay. Have you ever done a reperforation of</p> <p>3 a well increasing the number of shots-per-foot?</p> <p>4 A My company has. I specifically do not go out</p> <p>5 on the well and do reperforations. But I have been</p> <p>6 involved in the preparation of reports after that has</p> <p>7 been done.</p> <p>8 Q And in those instances you've not seen any</p> <p>9 difference in terms of permeability calculation?</p> <p>10 A Not that I can recall.</p> <p>11 Q Moving on, is the average permeability a</p> <p>12 function of a numeric average in terms of feet of</p> <p>13 sand? Because I thought when Mr. Hill was asking you</p> <p>14 questions you were correlating simply that hundred</p> <p>15 feet at a permeability of 81 millidarcies, and that if</p> <p>16 you added 45 feet to it, you calculated -- I think it</p> <p>17 was 1400 millidarcies would be necessary in order to</p> <p>18 bring the average up to 500 millidarcies. Is that an</p> <p>19 arithmetic average?</p> <p>20 A It's a weighted arithmetic average. In other</p> <p>21 words, approximately 69 percent, which would be 100</p> <p>22 over 145, has a permeability of 81 millidarcies as</p> <p>23 based upon the Fall-off test. If the remainder- 45</p> <p>24 out of 145 feet, that's approximately 31 percent --</p> <p>25 that is the unknown "X" and those two together, when</p>	<p style="text-align: right;">Page 1147</p> <p>1 JUDGE EGAN: Mr. Riley, I just have a</p> <p>2 quick question. Do you have many more questions?</p> <p>3 Because we have to adjourn at 6:00.</p> <p>4 MR. RILEY: We could break now and just</p> <p>5 pick up here. I probably have 10 more minutes, but</p> <p>6 I'm not --</p> <p>7 WITNESS GRANT: I'd rather finish up, if</p> <p>8 possible.</p> <p>9 JUDGE WALSTON: If we can get it in</p> <p>10 about 10 minutes, but I do need to leave shortly.</p> <p>11 MR. RILEY: I understand.</p> <p>12 JUDGE EGAN: Okay.</p> <p>13 Q (By Mr. Riley) Let me see if I understand.</p> <p>14 Is there any book or paper I could look to to verify</p> <p>15 your method of calculation in a weighted average</p> <p>16 context to understand how you came up with your 1400</p> <p>17 millidarcie calculation?</p> <p>18 A It's just a simple calculation of weighted</p> <p>19 averages, and I believe I have several textbooks that</p> <p>20 present that methodology.</p> <p>21 Q Okay. The methodology, as I understand it,</p> <p>22 is you take the least -- or less permeable sand and</p> <p>23 you say that's 69 percent of the -- of the perforated</p> <p>24 interval, correct?</p> <p>25 A Yeah. Maybe it's simpler to just break it in</p>
<p style="text-align: right;">Page 1146</p> <p>1 you take that weighted average, would have to equal</p> <p>2 500 millidarcies.</p> <p>3 Q But ultimately --</p> <p>4 A So to recalculate back to what your "X" is,</p> <p>5 that weighted average -- or that average for the</p> <p>6 remaining 45 would have to be over 1400 millidarcies</p> <p>7 to make the entire 145 feet have a net permeability of</p> <p>8 500 millidarcies.</p> <p>9 Q Mr. Grant, wouldn't it actually be exactly</p> <p>10 opposite of your calculation? Wouldn't more fluid</p> <p>11 exit out the more permeable sand and, therefore, be</p> <p>12 inverse of what you just calculated?</p> <p>13 A No, I don't believe so. In a Fall-off test,</p> <p>14 if you have the entire 145 feet over the period of the</p> <p>15 time of the Fall-off test, it would be 145 feet all</p> <p>16 take flow. You are getting a permeability value</p> <p>17 that's calculated off of that 145 feet. If only</p> <p>18 20 feet of that take flow, your permeability value is</p> <p>19 going to be calculated off that 20 feet, but your flow</p> <p>20 capacity, which would go into your pressure model</p> <p>21 would have a much lower thickness at that point. It</p> <p>22 would have a higher permeability but a lower thickness</p> <p>23 since they're both in the denominator of the pressure</p> <p>24 increase calculation. It would probably be a wash.</p> <p>25 Q Well, then --</p>	<p style="text-align: right;">Page 1148</p> <p>1 thirds. In other words, you have to say you assume</p> <p>2 150 feet total, and two-thirds of that -- that means</p> <p>3 50 feet and 50 feet have 81 millidarcies, and that</p> <p>4 third third is unknown. But the three of those added</p> <p>5 up together and divided by 3 would need to equal 500</p> <p>6 millidarcies.</p> <p>7 Q Okay. But again, if I'm following along, if</p> <p>8 I had an 800 millidarcy permeability in a sand layer</p> <p>9 that I used -- or wouldn't that be the preferential</p> <p>10 pathway under pressure for fluid? So wouldn't most of</p> <p>11 the fluid in this Fall-off test exit into the more</p> <p>12 permeable sand?</p> <p>13 A Yes, it would. An initial part of the</p> <p>14 Fall-off test, until it starts to build up pressure,</p> <p>15 and then it will start to flow into other sands that</p> <p>16 haven't pressured up or that have slightly lower</p> <p>17 permeability but now are accepting flow.</p> <p>18 So it's hard to make a judgment as to</p> <p>19 that 20-foot or whatever it is with a very high</p> <p>20 permeability taking the flow over the entire injection</p> <p>21 period. It is much more likely that the -- that in a</p> <p>22 virgin reservoir such as this that over the period of</p> <p>23 the Fall-off or the injection period that all the</p> <p>24 sands will take flow and an average will be gathered,</p> <p>25 which relates to the true average of that reservoir in</p>

1 the long-term to take fluid.

2 Q All right. I understand your position, and  
3 let me see one more time, just for absolute clarity,  
4 all of this would be verified by a Fall-off test post  
5 permit if you had -- if there was a condition that  
6 required it, correct? And that would answer the  
7 question, whether it be your method of calculation or  
8 Mr. Casey's method of calculation, it would be  
9 addressed in a Fall-off test?

10 A You mean calculation related to the  
11 permeability?

12 Q Yes, and as we talked about the radius of  
13 investigation of the fault to the --

14 A And the determination of a no-flow boundary  
15 to the south, those numbers would essentially be  
16 determined.

17 MR. RILEY: Thank you. No further  
18 questions.

19 JUDGE EGAN: All right. Mr. Williams?

20 MR. WILLIAMS: I have three short -- I  
21 hope -- questions, and if I can get short answers.

22 JUDGE EGAN: If you could speak up  
23 loudly though because we've got sirens going behind  
24 us.

25 MR. WILLIAMS: Right.

1 approximately?

2 A Well, the -- would have to be calculated  
3 based upon a formula or constant -- or monitoring the  
4 data as it's gathered during the injection period.  
5 But there are certain basic formulas you can use using  
6 worst-case permeabilities as to what the radius of  
7 influence would be. And so that would have to be  
8 calculated, but my guess is it would be anywhere from  
9 24 to potentially 72 hours of injection.

10 Q The Fall-off test that was conducted on Well  
11 315, do you remember how long it was run?

12 A I believe it was run for 12 hours at a  
13 certain rate -- I think 3 barrels-a-minute -- which is  
14 120-some gallons-per-minute.

15 Q And didn't you express some concern -- a  
16 little bit of concern in your deposition that it was  
17 possibly not run long enough but it was run long  
18 enough for you to accept the values. Is that correct?

19 A Yes, it was run long enough to get into  
20 radial flow to determine what the permeability of the  
21 reservoir within 1500 feet was. I just, as a rule of  
22 thumb, like to run injection periods on the -- on the  
23 Fall-off testing a minimum of 24 hours just for my own  
24 purposes.

25 MR. WILLIAMS: No further questions.

1 RECROSS-EXAMINATION

2 BY MR. WILLIAMS:

3 Q Mr. Grant, you testified about an instance  
4 where your client reperforated one of their wells?

5 A That is correct.

6 Q And there was no significant change in the  
7 Fall-off test. Is that correct?

8 A We're talking about where they reperforated  
9 the same sands they had already perforated?

10 Q Well, that's -- tell me. Why did they  
11 reperforate?

12 A They reperforated to get more holes per foot  
13 within the sands that they had already perforated.  
14 And it did not change to any substantial degree --  
15 meaning within 5 to 10 millidarcies what the resultant  
16 permeability as calculated was.

17 Q Then why did they do it?

18 A Because they were having problems with skin  
19 issues related to the current perforations that they  
20 had and somewhat plugging of the -- of those  
21 perforations.

22 Q Okay. You mentioned that the -- a test that  
23 would detect the 4400-foot boundary, whether it would  
24 be transmissive or no-flow boundary, plus a thousand  
25 feet beyond it needed to be long enough. How long,

1 Pass.

2 JUDGE EGAN: All right. Any redirect?

3 MR. HILL: No further questions, Your  
4 Honor.

5 JUDGE EGAN: All right. You have no  
6 questions -- then you're excused. Thank you very  
7 much.

8 WITNESS GRANT: Thank you.

9 JUDGE EGAN: Tomorrow morning -- I'm  
10 getting lost on where we're at. Is Lone Star --

11 MR. HILL: We have no more witnesses,  
12 Your Honor.

13 JUDGE EGAN: And do you have any more  
14 witnesses? You're finished, Mr. Walker?

15 Mr. Forsberg -- I think we're just down  
16 to staff. Is that correct?

17 MR. FORSBERG: I may have a couple of  
18 just little clean-up issues, but no witnesses.

19 JUDGE EGAN: All right. So we'll begin  
20 tomorrow morning with the staff's witnesses, other  
21 than some clean-up right in the beginning.

22 MR. RILEY: And I know Judge Walston  
23 needs to go, but just quickly what I anticipate right  
24 now is a very brief rebuttal. I would be surprised if  
25 it lasts more than two or three hours. And that

1 really largely depends on cross-examination.

2 As we talked about, I will attempt to  
3 file the direct of the rebuttal as prefiled rebuttal.

4 I don't have it together now, so I can't offer it  
5 probably more than a couple of hours before I actually  
6 finish it.

7 JUDGE EGAN: Okay. Then we're adjourned  
8 until tomorrow morning at nine o'clock.

9 (Proceedings recessed at 6:01 p.m.)

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